INTERNATIONAL ABSTRACT OF SURGERY

NOVEMBER, 1938

SURGERY AND THE BASIC SCIENCES

THE APPLICATION OF RECENT CONTRIBUTIONS IN BASIC MEDICAL SCIENCES TO SURGICAL PRACTICE

A. C. IVY, M.D., Chicago, Illinois

CEREBRAL MOTOR CORTEX

A SERIES of important researches pertaining to the physiology of the cerebral cortex has been conserved so that it might be presented as a more complete, and therefore, more intelligible story for the purposes of these reviews. Even then the story is such that the subject matter does not make the reading simple. Yet, these advances are considered so important that they cannot be omitted from any attempt to review the recent advances in the basic sciences. These advances are mainly concerned with: (a) clarification of the syndromes of the motor and premotor areas of the cortex, (b) experimental production of convulsive states and their control, (c) the rôle of the cerebral cortex in the regulation of autonomic functions, (d) the functions of the prefrontal association areas, and (e) localization of the functions within the sensory areas of the cortex.

It is a well known clinical principle that flaccid paralysis indicates a lower motor neurone lesion and that spastic paralysis usually indicates an upper motor neurone lesion. During the past few years experimental evidence has been accumulating which indicates that either flaccid or spastic paralysis may be produced by properly located lesions in the motor cortex. In 1934 Fulton and Kennard (1) summarized their investigations on the symptoms produced by ablation of various portions of the motor cortex in various primates. They maintained that ablation of that portion of the frontal lobe lying just anterior to the central sulcus (Brodmann's Area 4), which they call the motor area, results in a flaccid type of paralysis; ablation of the area just anterior to this (Brodmann's Area 6), which they call the premotor area, results in forced grasping, impaired motor power, and spasticity. They concluded that lesions of the pyramidal system produce flaccid paralysis, whereas lesions of the extra pyramidal system are responsible for spasticity.

In 1935 Walshe (2) subjected this view to a critical analysis and denied the adequacy of the evidence upon which the syndrome of the premotor area was based. He maintained that forced grasping is the only symptom which follows ablation of the premotor area. Much of his criticism was based on the fact that the physiological and histological evidence for the differentiation of motor and premotor areas was indefinite and unreliable.

In 1937 Hines (3) summarized the results of her investigations concerning the motor cortex of monkeys. She found that by the use of more adequate types of stimulating current, the histological Areas 4 and 6 could be accurately differentiated on the basis of the character of the responses obtained. All points from which isolated movements could be elicited were found to lie within Area 4. Only more complex movements resulted from stimulation of Area 6. The importance of the type, shape, and frequency of the current used for cortical stimulation has been emphasized by Wyss and Obrador (4) as well. These investiga-

Nathan Smith Davis Professor of Physiology and Pharmacology, Northwestern University Medical School

tors found that the ordinary inductorium does not deliver the proper kind of stimulus for excitation of the motor cortex. Using properly controlled condenser discharges they were able to elicit twitch responses in discrete muscles by applying a single stimulus to the cortex of Area 4. As the frequency of repeated stimuli was increased, the muscular response changed from repeated twitches to a tonic contraction. A single stimulus applied to Area 6 yielded a twitch with a slow relaxation component, and repeated stimuli entailed the gradual participation of larger and larger muscular groups. This work therefore brought the physiological and histological methods of differentiating separate cortical areas into agreement with one another. Hines (3) also discovered that electrical stimulation of the anterior border of Area 6 produced *inhibition* of movements. Ablation of this so-called "strip" area was found to result in slight temporary paralysis with persistent spasticity of the proximal joints. This spasticity was characterized by increased supportive reactions, by clonus produced in response to sudden and maintained stretching, and by exaggerated tendon reflexes; in other words the spasticity was comparable to that seen clinically. Ablation of Area 6 alone produced forced grasping only. Ablation of Area 4, exclusive of the "strip," resulted in paralysis with little if any evidence of spasticity. Hines interpreted these results to indicate that the pyramical projections from Area 4 are mainly responsible for carrying out volitional movements, whereas the extrapyramidal projections from the "strip" in one case and from Area 6 in the other inhibit extensor tone and the grasp reflex, respectively. In addition to these inhibitory functions the premotor area apparently integrates complex and highly organized movements by means of direct intracortical connections with Area 4.

Until recently there had been little direct evidence for the existence of the extrapyramidal projections from the "strip" area and Area 6 which were postulated above. Recently Levin and Bradford (5) have investigated the exact origin of the corticospinal (pyramidal) tract in monkeys as revealed by the retrograde degeneration produced by cervical hemisection of the cord. They found that the bulk of the fibers composing this tract originates in Area 4, although approximately 20 per cent arises in Areas 3, 1, 2, and 5 of the somatesthetic area of the parietal lobe. No pyramidal fibers were traced to Area 6, or to the "strip" area. Projection from these areas must therefore be extrapyramidal. Just as Hines had found that stimulation of the "strip" inhibited movements originating in Area 4, Dusser de Barenne and McCulloch (6) have recently reported that stimulation of the "strip" by means of the local application of strychnine suppresses the electrical manifestation of activity in the remainder of Area 4. These investigations established that the pathway mediating this inhibitory effect originates in the "strip," passes to the caudate nucleus, then, by way of the optic thalamus, passes to Area 4. This work provided direct evidence that projections from the "strip" area are extrapyramidal.

Fulton (7) in his recent excellent text book on the physiology of the nervous system offers the following interpretation of the situation. Primary removal of Area 6 causes abnormal muscular resistance, the quality and distribution of which does not conform with that characteristic of the human spastic state. The belief that lesions of Area 6 are concerned with spasticity was originally based on experiments in which Area 6 was removed after Area 4 had previously been ablated. Under these circumstances a previously flaccid extremity became highly spastic and remained so. "The explanation of this apparent discrepancy lies in the fact that the intensity and duration of spastic resistance are functions, not of any one area, but of the extent of interruption of the extrapyramidal cortical projections." The implication is that if all pyramidal projection could be interrupted, uncomplicated flaccid paralysis would ensue, and that if all extrapyramidal projections could be interrupted, extreme spasticity would result. However, because of the overlapping of the two systems it is difficult if not impossible to accomplish a complete interruption of one tract without injury to the other. *Since natural lesions are much less discrete than experimental ones, it is only to be expected as every clinician has found, that upper motor neurone lesions in man are accompanied in the vast majority of cases by spasticity.*

In regard to bilateral representation in the motor cortex, Bucy and Fulton (8) reported in 1933 that stimulation of the medial portion of the junction between Areas 4 and 6 in the monkey elicited ipsilateral responses. Wyss (9) has recently found that by employing an adequate type of stimulating current ipsilateral responses may uniformly be obtained. However, whereas the contralateral movements are of the usual clonic type, the ipsilateral movements are of the tonic type. Fulton and Kennard (1), Hines (3), and many others have noted that the degree of bilateral representation in the cerebral cortex increases as one passes from the central sulcus anteriorly over the frontal lobes.

Bilateral representation has been noted also in the regions controlling movements of the facial

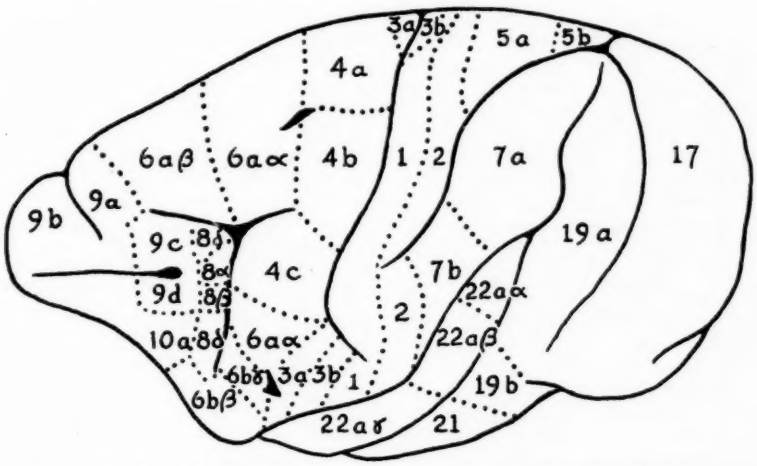


Fig. 1. This is a diagram illustrating the definition of the various areas in the cortex of the monkey. Area 4 is the prerolandic area or the area from which the pyramidal tract fibers arise. Area 6 is the premotor or extrapyramidal tract area.

musculature. Walker and Green (10) and Green and Walker (11) have made a detailed study of the corticomotor face area in monkeys, using both stimulation and ablation methods. They report that the lateral portion of the motor area No. 4 has direct projections to the labial muscles, orbicularis oculi, and intrinsic tongue muscles. The lateral portion of the premotor area No. 6 directly influences the activity of Area 4 without having extensive projections of its own. Other portions of Area 6 possess independent projections concerned with gross, and frequently rhythmical movements, particularly of the tongue and masticatory muscles, and with salivary secretion. They found that the lower facial musculature had predominantly contralateral representation, while the upper facial, lingual, pharyngeal, and laryngeal muscles were bilaterally represented to a considerable extent. An analysis of the factors responsible for the rather considerable recovery of motor control after ablation of the motor face area revealed the following to be involved: (a) the remaining ipsilateral cortex, (b) the contralateral motor cortex, (c) subcortical structures, and (d) other areas of the cortex, such as the parietal and prefrontal lobes.

It has been known for many years that some portion of the cerebral cortex plays a rôle in the modification of postural reflexes, since the latter become exaggerated and are more easily elicited and defined in the "thalamic" animal, i.e., one whose cerebral cortex has been removed. Bieber and Fulton (12) have recently shown that the motor and premotor areas of the cortex are responsible for this inhibition of postural reflexes.

Convulsions have been produced in experimental animals by strong electrical stimulation of the cerebral cortex, but until recently this has been done only in anesthetized animals. Fender (13) has employed a "remote control" method of cortical stimulation for the production of epileptiform convulsions in dogs. At a sterile operation, a solenoid is introduced under the skin with electrodes applied to any desired portion of the cortex. After complete recovery from the operation the animal is placed within the field of a primary coil. The current induced in the implanted solenoid delivers an electrical stimulus to the cortex of the unanesthetized, unrestrained animal. Fender has applied the method to stimulation of the arm, leg, and face areas of the dog. Stimulation for from ten to fifteen seconds produces a tonic contraction in the muscles represented in the area of the cortex directly affected. Shortly after the stimulation is withdrawn clonic movements appear which spread to neighboring structures with a typical march until all of one side of the body is involved. If the original stimulus has been adequate, a generalized convulsion of both sides of the body appears. At this time the animal slumps to the floor scarcely conscious. The seizure may last for three or four minutes, followed by rapid recovery, during which the animal shows signs of motor paresis in the affected limbs. Ward

and Clark (14) have also produced convulsive seizures in unanesthetized cats by stimulating previously implanted and projecting electrodes. They made the same observations as Fender, but extended them to include stimulation of other portions of the cerebral cortex. Irritation of the sensory area of the parietal lobe produced convulsions only after a longer delay. The typical march phenomena did not appear, for when the convulsions began, all parts of one side of the body were affected simultaneously. Stimulation of either the occipital or frontal eye areas produced contralateral deviations of the eyes. Following the convulsions, evidences of temporary cortical deficit were observed. Activity of the autonomic system was a constant phenomenon and included dilatation of the pupils, urination, vomiting, pilomotor reactions, and, if clonic contractions of facial and masticatory muscles were present, salivation. The close resemblance between these seizures in lower animals and jacksonian epilepsy in patients is obvious. The variations in the type of onset and the train of symptoms which were found to depend upon the function of the cortical area which had been irritated lends further support to the interpretation of these variations which have been made in clinical investigations. It is possible that the application of this method to a study of other portions of the brain in primates may serve to elucidate some of the more complex changes which are sometimes noted in human epilepsy, such as automatisms and psychic disturbances.

Generalized convulsions have also been produced in unanesthetized cats by the external application of electrodes to the head of the unoperated animal. Merritt and Putnam (15) have discovered a remarkable constancy in the threshold of current required to induce convulsions by this technique. This fact made the method useful in measuring the anti-convulsant properties of various drugs. Phenobarbital proved to be the most effective of the standard drugs used clinically in the treatment of convulsive states. Merritt and Putnam investigated a long series of drugs structurally related to phenobarbital in a search for a still more effective remedy. Several superior compounds, *especially diphenylhydantoin*, rewarded this search. *This additional quantitative approach to the study of the control of epilepsy is a valuable contribution.*

Recently cerebral control of autonomic functions has received increasing attention. Mention has already been made of certain autonomic phenomena associated with the cortex. Pinkston and Rioch (16) have recently confirmed the fact that ablation of the motor and premotor areas in monkeys produces an enduring contralateral vasoconstriction as revealed by changes in the skin temperature. Green and Hartzell (17) have traced the pathways mediating vasomotor effects in cats. In dogs, cats, and monkeys, Smith (18) has localized two regions of the premotor area, one of which stimulates, the other inhibits, activity of the respiratory center. Stimulation in this region was accompanied by swallowing and changes in the blood pressure. Lindsley and Sassaman (19) have studied an interesting subject who possessed voluntary control of his pilomotor reactions. Without inducing an emotional state of fear, and even while carrying on other activities, this subject could cause immediate erection of hairs. He was also able to inhibit this reaction under circumstances when it would naturally occur. Examination revealed that the pilomotor effect was accompanied by a generalized sympathetic discharge including increases in the cardiac and respiratory rates, dilatation of the pupils, sweating, and a slight increase in the blood pressure. The subject was unaware of these accompanying reactions. The induction of this sympathetic discharge was found to be reflected in electrical manifestation over the premotor area of the cortex, which attested to its cortical origin.

PREFRONTAL AREAS

The prefrontal association areas are of particular interest inasmuch as it is generally assumed that they are concerned with "intelligence" and the control of behavior. Jacobsen (20) has studied the "intellectual" deficit in monkeys and chimpanzees after bilateral ablation of the prefrontal areas. The animals were first trained in the performance of certain tests and problems. Bilateral removal of the prefrontal areas markedly impaired the ability of these animals to correctly carry out these tests and problems. The deficit is essentially a disturbance in the organization of movements and behavior and a failure to respond in accordance with recent sensory experience. One of the chimpanzees used in this study became so emotionally upset when it made mistakes that it was rapidly developing a neurosis. After removal of the prefrontal areas it became impossible to evoke these emotional reactions although the animal made mistakes much more frequently than before the operation. As a result of this observation, Moniz (21) in Portugal and, later, Freeman and

Watts (22) in this country have sectioned the prefrontal projections in the treatment of clinical nervous disorders with alleviation of the severe symptoms of the diseases.

Two recent reports have appeared which relate other symptoms which follow ablation of these areas in monkeys. Richter and Hines (23) studied the activity and restlessness of such animals by means of recording devices which provided quantitative information. Bilateral removal of the prefrontal cortex produced a marked increase in activity. This effect they were able to localize to Area 9 of the prefrontal cortex, Areas 8, 10, 11, 12 being without effect. Unilateral ablation experiments were not successful unless the excised tissue included the tip of the caudate nucleus and putamen. They concluded that Area 9 of the prefrontal cortex controls activity through mediation of the corpus striatum. The animals were much more easily distracted than normally. Kennard and Ectors (24) excised various portions of the prefrontal area in monkeys in an attempt to localize the area which is responsible for the ipsilateral deviation of the head and eyes and the forced circling movements which follow hemidecortication. It was found that Area 8, which lies just anteriorly to Area 6, is responsible for these symptoms. It is well known that stimulation of Area 8, which regulates eye movements, produce conjugate horizontal deviation of the eyes away from the side stimulated, followed by turning of the head. Monkeys with unilateral ablation of Area 8 showed, in addition to rotation of the eyes and head, forced circling, i.e., they were unable to walk except in circles. The animals were restless and apparently did not appreciate visual stimuli in the contralateral visual field. After bilateral ablation the animals tended to sit motionless with fixed gaze, and although they were not blind, as was shown by the fact that they followed moving objects, they were apt to run into obstructions, and they failed to realize that food presented to them was something to be eaten. Later they recovered a good deal, but retained a wooden expression and circled in either direction when walking. Stereotypy and the forced character of their movements were conspicuous; the animals apparently were hyperactive, although this condition was not measured quantitatively.

These areas of the frontal lobe have only extrapyramidal projections. In a study of the frontal lobe connections of the monkey, Levin (25) has reported that projections from Area 8 extend to the substantia nigra and to the tegmentum of the mesencephalon, and that projections from Areas 9 to 12, inclusive, send numerous fibers to the rostral part of the thalamus, particularly the lateral and ventral nuclei. In addition, certain fiber bundles extend to the substantia nigra and the pontine nuclei. Hirasawa and Kato (26) have described extensive tracts from Areas 8 and 9 to the head of the caudate and putamen.

Levin (27) has studied a number of children who exhibited marked restlessness and morbid hunger, accompanied by mental deficiency. A high incidence of cerebral lesions which were diffuse, but often most severe in the frontal lobes, was noted in these cases. These symptoms in children resemble those seen in animals after frontal lobectomy.

SOMATESTHETIC CORTEX

During the past few years several careful anatomical studies have been made of the fiber tracts which terminate in the somatesthetic area of the cerebral cortex. As a result of the work of Poliak (28), Walker (29), and Clark (30) it is known that thalamocortical projections terminate in Areas 4 and 6 of the frontal lobe, areas which are ordinarily considered to be exclusively motor areas. These fibers originate in the cerebellum and presumably subserve proprioceptive functions. Fibers which ascend in the spinothalamic tract are relayed by the thalamic nuclei to Areas 3, 1, and 2 of the postcentral convolution of the parietal lobe. It is noted that the posterior parietal lobule, which includes Areas 5 and 7, receives its main projections from the association nuclei of the thalamus, i.e., the pulvinar and lateral nuclei of the thalamus.

According to these anatomical studies the sensory cortex is more extensive than had generally been realized. There is both experimental and clinical evidence which substantiates the fact that the motor areas also have sensory functions. Dusser de Barenne (31) has studied the sensory phenomena, including hyperesthesia, paresthesia, and hyperalgesia, which can be produced in animals by the local application of strychnine to the thalamus and to the cerebral sensory cortex. His results revealed that the sensory area of the cortex extends into the frontal lobe motor areas. He found in addition that there are sharply defined sensory areas for arm, leg, and face in both the cortex and in the thalamus. Thus the physiological as well as the anatomical evidence reveals an important interrelationship between the thalamus and the sensory cortex. Skin sensibility, such as

pain and temperature, showed extensive bilateral representation in both cortex and thalamus, whereas the deeper sensibilities showed contralateral representation almost exclusively. Since local strychninization of one arm area produced symptomatology in the cutaneous sensibility of both arms, even after removal of the opposite cortex, Dusser de Barenne believes that the local strychninization must "fire" the whole arm area of both the cortex and the corresponding area of the thalamus. "Firing" of the latter may then be responsible for the bilateral symptomatology. According to this view the thalamus must subserve a high level of sensory integration. It is well known that pain may be recognized at the thalamic level; this may also be true for other gross sensations. This leaves for the cortex the rôle of differentiation within sensation, i. e., localization of sensory stimuli (topognosis), and discrimination between degrees of roughness, weight, size, and shape (stereognosis). Recently Dusser de Barenne and McCulloch (32) have extended this work to a study of the effect of local strychninization on the electrical activity of various areas of the brain in monkeys. In these experiments they have been able to show that local strychninization of a small area of the cortex markedly increases electrical activity in corresponding areas of the thalamus. These results therefore support their original interpretation. Penfield and Boldrey (33) have mapped in some detail the sensory areas of the human cortex. They. obtained sensory responses to stimulation in the motor areas of the frontal lobes. By means of electrical stimulation in patients able to describe the sensation and its apparent location they were able to localize somatic areas in much greater detail than can be done with strychnine in animals.

Woolsey and Bard (34) have also provided evidence that the precentral areas are concerned with sensory functions in monkeys. Ablation of the parietal cortex abolished placing reactions which are dependent upon tactile sensations, but hopping reactions, which depend upon proprioceptive sensations, were not affected and must therefore be mediated by frontal lobe areas. The results obtained by stimulation, ablation, and anatomical studies are therefore in accord in showing that the precentral cortex subserves the sensory functions as well as the motor functions, and that the former are mainly proprioceptive in nature.

If, as mentioned above, the rôle of the sensory cortex is mainly that of discrimination, then impairment of this function should be detectable following excision of the parietal lobes. Ruch, Fulton, and German (35) tested the ability of the monkey, chimpanzee, and man to discriminate differences in weight, roughness, and shape of objects after destruction of the parietal lobes. The operation had very little effect in monkeys; in chimpanzees the deficit could be corrected by training; in man a residual deficit remained which could not be corrected by training. These results revealed an increase in the degree of corticalization of sensory discrimination in the higher forms. Excision of various portions of the parietal lobe gave no evidence for localization of discriminatory ability in any particular area.

Marshall, Woolsey, and Bard (36) have recently conducted some interesting experiments on anesthetized monkeys in which tactile stimuli were applied to various portions of the body surface and the location of the consequent electrical potential waves on the cerebral cortex were mapped. By this method they found a very definite and discrete representation of tactile sensibility in Areas 1, 2, and 3 of the postcentral lobule of the parietal lobe. The parts of the contralateral surface were found to be represented in an orderly sequence on the surface of the cortex. "In the case of the lower extremity this sequence clearly reflects the metameric origin of the dermatomes; the arrangement is in the order of spinal innervation, not in the order—hip, thigh, knee, leg, ankle, foot, toes." No evidence for bilateral cortical representation of tactile sensation was found except for the face. There was some evidence, however, that strong stimuli capable of eliciting pain might give rise to cortical potentials in both somatesthetic areas. It was also noted that when a stimulus was accompanied by a movement, potential waves were detectable in the precentral area. This is additional evidence in favor of the view that the sensory projections to the precentral areas are proprioceptive in nature.

THYMUS

Many years ago, Soli (37) and Riddle (38) reported that the thymus gland is necessary for the formation of the egg shell and egg white in chickens. Reports have also occasionally appeared which professed to implicate the thymus gland in bone formation and calcium metabolism. Recently Maughan (39) has made a careful investigation in chickens regarding these claims. He found no difference in growth curves between thymectomized chickens and controls, nor was

there any difference in the age of maturity. When the chickens were placed upon a rachitogenic diet, which was calculated to reveal any disturbances of the calcium metabolism, the time of appearance and the severity of the rickets was identical in thymectomized and control animals. No difference in blood-calcium levels could be detected. Egg production began at the same time in the two series, and the eggs laid by the thymectomized chickens could not be distinguished from those laid by the control animals.

It has generally been assumed that if the thymus gland is an endocrine organ, it must be concerned with growth. The early literature contains numerous papers concerned with this aspect of the question. However, in 1919 Park and McClure (40) concluded from their own careful work and a critical review of the literature that extirpation of the thymus produces no detectable alterations in the growth, development, strength, activity, or intelligence of experimental animals. More recently Rowntree, Clark, and Hanson (41) have reported that daily intraperitoneal injections of an extract prepared from the thymus, continued over several generations of rats, will markedly hasten the rate of growth and maturation of offspring. Following this lead, Einhorn and Rowntree (42) found that thymectomy continued over several generations of rats resulted in the retardation of growth. It has recently been reported that thymus implants (Einhorn and Rowntree, 42) or the administration of thymus extract (Einhorn, 43) will correct the deficiency produced by extirpation of the thymus over several generations. It is rather difficult to understand the significance of an endocrine gland, the influence of which is exerted solely on the offspring. Nor is the rôle of the thymus in regulating growth and development clarified by the reports of Asher (44) and his co-worker Nowinski (45) who state that highly purified thymus extract (thymocrescin) stimulates growth, overcomes the loss of weight incident to a diet deficient in vitamins, and causes enlargement of the gonads in the injected generation.

In 1932 Andersen (46), in her review on the thymus gland, was able to conclude only two facts: gonadectomy delays thymic involution, and gonadal implants hasten involution. Recently Lauson, Heller, and Sevringhaus (47) and Inay and Thompson (48) have shown that gonadectomy not only delays involution but produces an actual hypertrophy. Lauson *et al.* found that small doses of estrone prevent this hypertrophy and larger doses produce involution. Inay and Thompson reported that testosterone, as well as estrone, caused thymic atrophy. Progesterone was without effect on the thymus. These results were also obtained by Schacher, Browne, and Selye (49) in adrenalectomized animals. The final link in the chain was provided when Inay and Thompson found that gonadotropic hormone hastened atrophy of the thymus in animals with intact gonads. Thus the rapid involution of the thymus which occurs after puberty is the result of the increased production of sex hormones which is presumably controlled by the hypophysis.

That other endocrines may be involved in this process is suggested by recent studies on the interrelationship of the thymus and adrenal glands. Inay and Thompson (48) reported that enlargement of the thymus followed adrenalectomy as well as gonadectomy. Selye (50) has studied the "alarm reaction" which consists of adrenal enlargement, involution of lymphatic tissue including the thymus, cellular degeneration in various tissues, ulcer formation in the gastro-intestinal tract, and edema. This reaction is a non-specific response to severe damage, which may be produced by a variety of agents, such as drugs, surgical trauma, and spinal shock. He found that although adrenalectomy aggravated most of these symptoms of the "alarm reaction," it prevented the usual atrophy of the thymus. Moon (51) has reported severe atrophy of the thymus after the administration of adrenocorticotropic hormone to castrated rats. Ingle (52) reported the same reaction to injections of adrenocortical extracts. These results suggest that the adrenal cortex may be an important factor in the activity of the thymus gland.

Although this recent work reveals the influence of other organs on the thymus, it sheds very little light on the influence of the thymus on structures and functions of the body. Attempts to demonstrate a relationship between the thymus and genital development have been numerous but contradictory. Recently Gershon-Cohen, Shay, Fels, Meranze, and Meranze (53) have used x-ray irradiation of a localized area over the thymus to produce involution in newborn rats. The rat was selected because it is relatively immature at birth and maximal effects from thymic inactivity would be anticipated. The most marked effects were noted in the male rats which were irradiated. These animals showed a retardation in growth, enlargement of the adrenals and hypophysis, and underdevelopment of the gonads. Histological examination revealed a complete absence of spermatogenesis in the male gonads, a finding which was supported by the fact that these animals were found to be sterile. On the basis of these findings these authors point out the possible

detrimental effects which might follow irradiation of the thymus in infants.

BIBLIOGRAPHY

1. Fulton and Kennard. Ass. Res. Nerv. and Ment. Dis., 1934, 13: 158.
2. Walshe. Brain, 1935, 58: 49.
3. Hines. Johns Hopkins Hosp. Bull., 1937, 60: 313.
4. Wyss and Obrador. Am. J. Physiol., 1937, 120: 42.
5. Levin and Bradford. J. Comp. Neurol., 1938, 68: 411.
6. Dusser de Barenne and McCulloch. J. Neurophysiol., 1938, 1: 364.
7. Fulton. The Physiology of the Nervous System. New York, Oxford University Press, 1938.
8. Bucy and Fulton. Brain, 1933, 56: 318.
9. Wyss. J. Neurophysiol., 1938, 1: 125.
10. Walker and Green. Ibid., 1938, 1: 152.
11. Green and Walker. Ibid., 1938, 1: 262.
12. Bieber and Fulton. Arch. Neurol. and Psychiat., 1938, 39: 435.
13. Fender. Ibid., 1937, 38: 259.
14. Ward and Clark. Ibid., 1938, 39: 1213.
15. Merritt and Putnam. Ibid., 1938, 39: 1003.
16. Pinkston and Rioch. Am. J. Physiol., 1938, 121: 49.
17. Green and Hartzell. Ibid., 1938, 123: 81.
18. Smith. J. Neurophysiol., 1938, 1: 55.
19. Lindsley and Sassaman. Ibid., 1938, 1: 342.
20. Jacobsen. Ass. Res. Nerv. and Ment. Dis., 1934, 13: 225.
21. Moniz. Tentatives operatoires dans le traitement de certaines psychoses. Paris: Masson et Cie., 1936.
22. Freeman and Watts. South. M. J., 1937, 30: 23.
23. Richter and Hines. Brain, 1938, 61: 1.
24. Kennard and Ectors. J. Neurophysiol., 1938, 1: 45.
25. Levin. J. Comp. Neurol., 1936, 63: 369.
26. Hirasawa and Kato. Folia Anat. Japon., 1935, 13: 189.
27. Levin. Arch. Neurol. and Psychiat., 1938, 39: 764.
28. Poliak. The Main Afferent Fiber Systems of the Cerebral Cortex in Primates. Berkeley, Calif.: University of California Press, 1932.
29. Walker. J. Comp. Neurol., 1936, 64: 1.
30. Clark. J. Anat., 1936, 71: 7.
31. Dusser de Barenne. Ass. Res. Nerv. and Ment. Dis., 1935, 15: 274.
32. Dusser de Barenne and McCulloch. J. Neurophysiol., 1938, 1: 69, 176.
33. Penfield and Boldrey. Brain, 1937, 60: 389.
34. Woolsey and Bard. Am. J. Physiol., 1936, 116: 165.
35. Ruch, Fulton, and German. Arch. Neurol. and Psychiat., 1938, 39: 919.
36. Marshall, Woolsey, and Bard. In Macleod, Physiology in Modern Medicine. St. Louis: C. V. Mosby Co., 1938.
37. Soli. Pathologica, rivista quindicinale (Geneva) 1911, 3: 118.
38. Riddle. Am. J. Physiol., 1924, 68: 557.
39. Maughan. Ibid., 1938, 123: 319.
40. Park and McClure. Am. J. Dis. Child., 1919, 18: 317.
41. Rowntree, Clark, and Hanson. J. Am. M. Ass., 1934, 103: 1425.
42. Einhorn and Rowntree. Endocrinology, 1938, 22: 342.
43. Einhorn. Ibid., 1938, 22: 335.
44. Asher. Endokrinologie, 1930, 7: 321.
45. Nowinski. Biochem. Ztschr., 1932, 249: 421.
46. Andersen. Physiol. Rev., 1932, 12: 1.
47. Lauson, Heller, and Sevringhaus. Endocrinology, 1937, 21: 735.
48. Inay and Thompson. Am. J. Physiol., 1938, 123: 106.
49. Schacher, Browne, and Selye. Proc. Soc. Exper. Biol. & Med., 1937, 36: 488.
50. Selye. Endocrinology, 1937, 21: 169.
51. Moon. Proc. Soc. Exper. Biol. & Med., 1938, 37: 34.
52. Ingle. Ibid., 1938, 38: 443.
53. Gershon-Cohen, Shay, Fels, Meranze, and Meranze. Am. J. Roentgenol., 1938, 39: 263.

ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Da Costa, F.: Surgery of the Temporomandibular Joint (Notas sôbre a cirurgia da temporo-maxilar). *Bol. clin. estat.*, 1937, 1: 31.

After having briefly discussed the anatomical and physiological aspects of the temporomandibular joint, Da Costa enumerates the various pathological conditions involving this highly specialized articulation.

Temporomandibular ankylosis is fortunately a rare condition, although it is one of the most important ones as can be seen from the statistics of Bassini and Orlow in 1910. Any ankylosis of this joint immobilizes the mandible. The immobilization may be due also to scarred mucous surfaces in the buccal cavity, and to muscular hypertonia either of toxic or infectious origin (trismus).

Bassini defines a true ankylosis as a condition characterized by pathological alterations of the parts which constitute a joint.

Although this condition may occur at almost any age, Orlow notes that in about 65 per cent of the cases it occurs in early infancy and adolescence. Da Costa believes that this high incidence in children and babies is due: (1) to their predisposition to the exanthematous fevers which are frequently complicated by endo-articular changes, and (2) to the fact that the periosteum in that age group has a high osteogenetic capacity.

According to Orlow, trauma such as a fall on the chin, a blow in the face, or a fracture, is the most frequent cause. Other causes are trauma to the wisdom tooth, and arthritic conditions due to gonorrhea, scarlet fever, typhoid fever, measles, and diphtheria. The condition may also be congenital. Because of the fact that only a few cases have come under the author's personal observation, he is unable to determine the incidence of the various causes.

From a surgical point of view little information is found in the literature concerning the anesthesia to be employed, the postoperative treatment, and the roentgenological examination.

Concerning the anesthesia, it was customary prior to the advent of local anesthesia to use general anesthesia, which was fraught with considerable danger because of the possibility of asphyxia resulting from the aspiration of vomitus. The author, therefore, suggests the use of infiltration anesthesia with a 1-per-cent novocaine solution and adrenaline. For a good infiltration about 20 c.cm. are sufficient.

When an injection is made into the posterior portion of the condyle, care should be taken that the external auditory canal is not injured and that a large blood vessel is not entered inadvertently.

Concerning postoperative treatment, the author states that absence of movement sets up a vicious circle which leads to edema of the connective tissue and muscular atrophy due to hyponutrition. In order to avoid these often irreparable consequences, the author suggests active exercise, which is in his opinion more beneficial than passive exercise. Active exercise should not be limited to only a few periods during the day but should be continued also during the night. Suitable instruments, such as wedges made of wood, bark, or rubber, may be used for this purpose. The rubber wedges prove most satisfactory because traumatism to the teeth is avoided by the equal distribution of the forces. Care should be taken that the patient does not swallow the wedge. Other more elaborate devices, such as Darcissac's, may also be employed with good results.

Da Costa finally emphasizes the importance of adequate x-ray films in order that a good visualization of the lesion be obtained. With the aid of roentgenological visualization the surgeon may select the most suitable type of intervention.

The author presents a series of cases which were treated according to the foregoing principles, and offers several interesting and instructive illustrations. RICHARD E. SOMMA, M.D.

EYE

Birge, H. L.: Cancer of the Eyelids: I. Basal-Cell and Mixed Basal-Cell and Squamous-Cell Epithelioma. *Arch. Ophth.*, 1938, 19: 700.

Recently the records of 464 cases of cutaneous cancer which arose from the eyelids or the conjunctiva, or from both, were studied. Of the carcinomas in this series, 230 were examined and graded histologically. Of the 230 growths, 139 were basal-cell epitheliomas, and approximately 14 per cent, or 32 of them, were mixed basal-cell and squamous-cell epitheliomas. This paper is primarily concerned with these two groups.

The cause of all types of epithelial tumors is related to some extent to trauma and to chronic irritation. In this series, 29.5 per cent of the basal-cell epitheliomas were said to be definitely related to these factors. Of the mixed-cell epitheliomas, 31.2 per cent were associated with a history of chronic irritation of some type.

In 19 of this group of 139 cases of basal-cell epithelioma, the most radical type of treatment was used; that is, exenteration of the contents of the orbit. In 9 other cases it was necessary to enucleate the globe. In many of these cases varying doses of radium were given in addition. Treatment of the remainder of

the cases consisted of excision, including diathermy and cauterization, or a combination of operation and irradiation.

In this series, exenteration was performed on 20.7 per cent of the patients with mixed-cell epithelioma and on only 14.9 per cent of those with pure basal-cell epithelioma. This difference in treatment may be in favor of the prognosis of the mixed type of tumor, the more radical method causing a lower gross mortality. If such is the case, the malignancy of the mixed basal-cell and squamous-cell epithelioma is not as much lower as it appears.

Of the 139 patients with basal-cell epithelioma, contact was maintained with 127 until 1936. In some cases this represented a follow-up study of more than fifteen years' duration. The mortality rate of the basal-cell epitheliomas of the eyelids was 11 per cent; that of mixed basal-cell and squamous-cell epitheliomas was 6.8 per cent.

Of the patients who had basal-cell epithelioma of the eyelid, 46.1 per cent lived fifteen years or more after they received treatment. Of the patients who had mixed basal-cell and squamous-cell epithelioma, 75 per cent lived fifteen years or longer after treatment was received.

The basal-cell lesion was more malignant than was either the mixed basal-cell and squamous-cell epithelioma or the lower grades of pure squamous-cell epithelioma.

Blindness resulted from basal-cell epithelioma in 25.9 per cent of the affected eyes in 127 patients in whom a follow-up study was made. Blindness was equally frequent in the group of patients with mixed-cell epithelioma.

Epitheliomas near the eyelid and conjunctiva show definite variation in their ability to cause blindness and death, according to their pathological types. It is important for the clinician to know whether an epithelioma is of the basal-cell type, the squamous-cell type, or a mixture of both.

The prognosis varies not only with the pathological type, but with other factors, including age of the patient, size of the lesion, the type of treatment received previously, and occupation of the patient. Especially important with regard to the treatment of the early lesion is its situation on the eyelid. The chief danger associated with any tumor of the eyelid lies not so much in the occurrence of metastasis as in extension of the process into the orbit and into the cranial cavity.

To the ophthalmologists, the basal-cell lesion of the eyelid becomes important in proportion to its ability to blind or to kill. The mortality and blindness resulting from basal-cell epithelioma could be reduced considerably if patients would report earlier for treatment and if they were observed more regularly after treatment had been given, until they were cured. Only 20 per cent of the patients in the entire series of 464 sought adequate treatment in the course of the first year.

In order to save time, which is important in dealing with malignant growths of high grade, epitheliomas should be examined histologically before a definite course of treatment is chosen.

MOUTH

Duffy, J. J.: Cervical Lymph Nodes in Intra-Oral Carcinoma: Surgery or Irradiation? *Am. J. Roentgenol.*, 1938, 39: 767.

In discussing the evolution of the treatment of intra-oral carcinoma the author outlined indications and contra-indications for neck dissection using 252 cases of carcinoma of the lateral border of the tongue which had undergone treatment from 1923 to 1931. In the light of these criteria he arrived at the following conclusions:

1. Radical surgery of the cervical region should be delayed until the primary lesion is apparently controlled, but moderate external irradiation to the neck may be given as a growth restraint in the interval.

2. When the disease involves both sides of the oral cavity, i.e., originates in the midline or extends across it, radical surgery is contra-indicated because it is unlikely that the primary lesion can be controlled and because bilateral neck dissection has rarely eradicated bilateral disease.

3. The grading of the tumor and its location may contra-indicate operation because of the invasive character of the tumor and the danger of ulceration and hemorrhage following operation. Statistically, the author finds that the location of the tumor and its malignancy can be closely correlated.

4. About 50 per cent of the series of 85 patients with operable nodes in the neck were irradiated and the rest were operated upon; 11.4 per cent of the irradiated group and 21.9 per cent of the operative group were alive after five years.

5. In the absence of palpable cervical metastasis, operation is contra-indicated because in this series 40.8 per cent of the patients showed no evidence of node involvement throughout the disease. Only about 20 per cent developed operable nodes and 10 per cent developed inoperable nodes, the latter group presenting highly malignant or bilateral types. If routine neck dissection had been done, there would have been 123 unnecessary operations.

BRADFORD CANNON, M.D.

Jacox, H. W.: Irradiation of the Cervical Glands in Carcinoma of the Mouth and Lip. *Am. J. Roentgenol.*, 1938, 39: 778.

The author discusses the different opinions regarding the method of treatment of the cervical lymph nodes in carcinoma of the lip, tongue, and mouth, with particular emphasis on cases without palpable lymph nodes. He then outlined his methods of treatment, which are as follows:

1. In the absence of visible or palpable nodes, high-voltage irradiation is given to each side of the neck for a period of from ten to fourteen days until there is a definite visible erythema. This does not interfere with later neck dissection.

2. When movable nodes are palpable, similar irradiation is given, followed in from two to six weeks by radical neck dissection if the primary lesion appears to be controlled. No further irradiation is given unless there is a recurrence.

3. If the nodes are fixed, irradiation is given to the neck, followed in from two to four weeks by a wide surgical exposure of the area and implantation of radium needles (from two to eight 10 mgm. needles), which are permitted to remain for from eighteen to thirty hours. Under no circumstance does the author advise the removal of neoplastic tissue before the application of radium.

4. If the growth has perforated the skin with ulceration and secondary infection, caustic irradiation followed by high-voltage irradiation occasionally produces healing.

The author then presents 2 illustrative cases treated by these methods, with photomicrographs to show the resultant changes in the tissue following irradiation.

5. If the capsule of the node is involved as indicated by the physical findings, operation is futile because of the high degree of malignancy of the tumor and the unavoidable contamination of the operative field with subsequent local recurrence.

6. Neck dissection is contra-indicated in the presence of bilateral metastases; it is also contra-indicated when there is contralateral involvement, because this involvement extends to the ipsolateral nodes.

7. Distant metastases contra-indicate operation.

8. The general condition of the patient and the life expectancy must be considered before any radical surgery is undertaken.

The author concludes by stating that surgery offers a better chance of cure in the operable cases, whereas in the advanced cases well outlined irradiation treatment will give a longer life expectancy and greater comfort than an extreme and futile operative procedure. BRADFORD CANNON, M.D.

PHARYNX

Martin, H. E.: The Treatment of Pharyngeal Cancer. *Arch. Otolaryngol.*, 1938, 27: 661.

Martin believes that the treatment of malignant tumors of the pharynx is mainly a problem of irradiation, although surgical intervention often must be employed as well to facilitate the placement of interstitial implants and for the management of the complications following aggressive radiation therapy. Since the introduction of protracted, or fractionated, roentgen irradiation, as developed by Coutard, the results of treatment of pharyngeal cancer have greatly improved. The favorable results obtained in a certain percentage of cases, in the author's opinion, have led to some overenthusiasm and to attempts to cure all forms and stages of pharyngeal cancer by protracted roentgen irradiation alone. The exclusive employment of roentgen irradiation in all cases is, in all likelihood, not the best solution

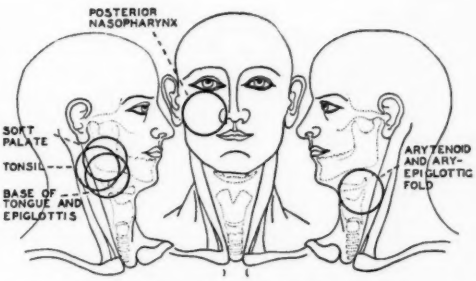


Fig. 1. The position of skin portals for the treatment of lesions in various anatomical locations. The use of small portals requires accurate localization according to the site of the underlying tumor.

of the problem of pharyngeal cancer. Complementary or supplementary interstitial irradiation with gold radon implants in combination with protracted roentgen irradiation will permit the control of conditions which would resist treatment by any single method.

A combination of the two methods is of particular value for the treatment of an especially resistant portion of the primary lesion, a cervical node, or such cervical metastases as may not be included advantageously within the skin portal except by the use of excessively large fields. The open mouth may be utilized as an additional portal for the treatment of many intra-oral lesions and lesions of the upper part of the pharynx. Undue effects on the skin and heavy irradiation through the salivary glands and the mandible are thereby avoided.

In the region of the palatine tonsil one may expect favorable results from radiation therapy. In the tonsillar region, the supplementary use of gold radon seeds immediately on completion of the protracted external irradiation is both safe and highly desirable for the treatment of residual tumor or of resistant portions of the growth, which are often found when the tumor has invaded the soft palate and the base of the tongue. A growth in the epiglottis should in most cases be dealt with by external irradiation alone. For the aryepiglottic fold, arytenoid, and piriform sinus, external irradiation must bear the entire burden of treatment of the primary lesion, except in cases in which an adjacent cervical node may be used to hold the radon seeds, not only for the control of the node itself but for irradiation of the adjacent primary lesion.

To procure the most favorable results in the treatment of pharyngeal cancer Martin depends chiefly on protracted roentgen irradiation, but the highest degree of success depends on the proper combination of methods and the supplementary use of interstitial irradiation with radon in a considerable percentage of cases. The technique used in the treatment of pharyngeal cancer at the Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York, is discussed in detail. NOAH D. FABRICANT, M.D

NECK

Sciaky, I.: Experimental Hyperthyroidism in Different Species of Animals (Hyperthyroïdisme expérimental chez différentes espèces animales). *Ann. d'anat. path.*, 1938, 15: 165.

In order to produce experimental hyperthyroidism the author used thyroxin by hypodermic injection. Eighteen animals were used in 3 groups as follows: (1) 2 guinea pigs, who received large doses of thyroxin and who survived only eight and ten days respectively; (2) 2 guinea pigs, 3 rabbits, 2 cats, and 2 rats, all of which received small repeated doses for periods varying from seventy-seven to one hundred and ninety-six days; and (3) 2 guinea pigs, 1 rabbit, 1 cat, and 3 rats, all of which received small doses of thyroxin plus small doses of copper for one hundred and thirty-four to two hundred and ninety-four days. The copper was given with the idea that it would induce certain toxic visceral changes and thereby intensify the action of the thyroxin. Most of the animals died spontaneously. The organs were fixed in Mueller formalin and alcohol, embedded in paraffin and celluoidin, and stained with hematoxylin-eosin, Scharlach rot, van Gieson or Unna-Pappenheim stain, or according to the method of Tibor-Pap. A few were stained with Ziehl's stain.

The control of the degree of intoxication was found to be rather difficult, as there is no accurate criterion for judgment. The best criterion was found to be the degree of loss of weight. Except in the cases of acute intoxication, the thyroxin was not administered regularly by a certain dose at a certain time, but was so spaced as to produce a slow but steady loss of weight. It was found possible to maintain a slow fall in weight until the last three or four weeks before death at which time the loss of weight became much more rapid, though regular, and terminated in exitus.

In the acute intoxication, daily or twice daily injections were given. The 2 animals became restless, ceased to eat, lost weight (33 and 45 per cent, respectively) and died on the eighth and tenth days. In this time the total amount of thyroxin received was greater than that used in the cases of chronic intoxications with injections spread over from six to ten months.

In the chronic intoxications with small doses of thyroxin alone in 9 animals the loss of weight varied from 19 to 47 per cent. The hair of the head was lost, especially in the cases of guinea pigs. Subcutaneous fat disappeared. The organs were hyperemic. Small pin-point hemorrhages were found in the stomach, but no ulceration.

In the 7 animals receiving both thyroxin and copper, the progress was essentially the same as in the preceding group.

Complete protocols are given for all 18 animals. In summary, the findings consisted of loss of weight and visceral changes in the liver, heart, kidneys, spleen, hypophysis, parathyroids, and pancreas. In the heart and liver, they were characterized by a richly vascularized fibrosis. In the liver the action apparently started at the periphery of the lobule and produced a parenchymatous degeneration of the cells similar to that produced by other toxic agents. There was a marked reduction in fat and almost complete absence of glycogen, factors which probably preceded the degenerative changes. The fibrosis was probably preceded by a condition of serous inflammation, i.e., hyperemia, edema, and degeneration without lymphocytic or leucocytic reaction. These effects were lessened by the simultaneous administration of copper.

The pancreas of the guinea pigs presented remarkable modifications. In the acute intoxication there was degeneration amounting almost to necrosis of the islets. In the chronic intoxication, there was hypertrophy of the insular apparatus amounting to 2 or 3 times that found in the normal. The application of these experimental facts may indicate that the thyroid hormone stimulates pancreatic hyperplasia, which in turn empties the liver of its reserves.

MAX M. ZINNINGER, M.D.

THE SURGICAL TREATMENT OF HYPERTENSION

Collective Review

JOHN MARTIN, M.D., Chicago, Illinois

IMPRESSED by the widespread interest in the treatment of essential hypertension, Leriche (77) in 1935 made the statement: "Le traitment chirurgical de l'hypertension artérielle est à l'ordre du jour." Fitting as it was for that year, it is even more applicable to the present time, for the current medical literature is filled with clinical and experimental reports on the subject of hypertension, and so complex has the subject become through the work done, both important and insignificant, on the etiology and surgical therapy of hypertension, that the rapidly expanding literature threatens to reach the state of confusion which existed a few years ago on the subject of endocrine physiology. The surgical treatment of hypertension is, indeed, the subject of the day.

A search through the literature of recent years on the subject of hypertension, especially relative to the surgical treatment of this syndrome, reveals a startling multiplicity of theories as to its cause and nature, and an equal or greater number of suggestions for its proper treatment. It is obvious that in a review of this nature all these hundreds of articles cannot be quoted or even referred to, but an attempt has here been made to bring together into a condensed form the present-day concepts concerning the nature of hypertension and its treatment by surgical means, as well as an interpretation of some of the more important experimental work which is being done. Time alone has proved the fallacy of many theories. Many reports were clearly without logical conception in their beginning. Much unjustified surgery has been done and is still being done, a condition which has existed, no doubt, in the early treatment of every perplexing disease entity in which surgery was employed. Worthless reports, carelessly conducted experiments, repeated theorizing without experimental basis, futile classifications, and other factors have produced such a complexity of ideas and confusion of purpose that until quite recently it seemed that the surgical treatment of hypertension offered little promise of help. It is encouraging, however, that the past year or two finds some order arising out of the chaos, that collective thinking and agreement are occurring among surgeons, and that more and better experimentation is being done.

From some quarters come bitter criticisms against the use of surgery in the treatment of hypertension, and the usual argument is that treatment as radical as sympathectomy should not be employed for a *symptom*, of which the *cause* is still unknown. It is true, unfortunately, that the etiology of, or pathological basis for, hypertension is in the main unknown, but surgery has in many instances given undeniable relief where medical treatment has admittedly failed. By some men, mainly unsympathetic toward surgical treatment, hypertension has been postulated to be the result of high protein diet, emotional stress, obesity, the menopause, worry and overwork, tobacco, alcohol, "auto-intoxication," intestinal absorption of streptococcic toxins (Rose, 1933), goiter (King, 1933), gonadotropic-hormone imbalance, syphilis, hereditary influences, and dozens of other environmental and physiological factors. The individual physician has treated his patients according to his theory of the cause. Carbon-dioxide baths, mud baths, hydrotherapy, intestinal douches, various forms of rest, various forms of exercise, drugs of various and conflicting types, watermelon-seed extract (Althauser and Kerr, 1929), psycho-analysis (Menninger), diathermy (Gunewardene, 1933), active and passive movements of the spinal column (Cyriax, 1917), veratrim veride (Douthwaite, 1931), and even prayer have all been used by different clinicians, and, as might be expected, the reports of their success are often glowing with enthusiasm. Such an admixture of theory and irrational treatment necessitates no comment, and it leaves little ground for criticism of the efforts of surgeons to ameliorate the ill effects of hypertension, if they are treating only a symptom, so long as their surgical attempts are guided by careful clinical and experimental study of their problem.

EXPERIMENTAL INVESTIGATIONS

One of the greatest obstacles in the understanding of the nature of hypertension is the fact that the physiology of the autonomic nervous system

From the Division of Surgery, Northwestern University Medical School, Chicago.

and of the endocrine glands remains incompletely understood. Experimental study on the problem of hypertension has been largely directed toward an elucidation of the function of the autonomic and endocrine systems alone, with one another, or with the rest of the organism, and this, of course, is no small undertaking. Germany, France, Italy, and South America have each produced a considerable volume of work on the study of experimental hypertension, but by far the most extensive and most productive of result has been the work done in the United States during the past four years. It is hoped that this present active interest in experimentation may lead to the optimal treatment of hypertension, be it medical or surgical, or a combination of the two, and some recent investigations are especially encouraging in this light. (58, 176, 159).

Early animal experimentation was slow to produce results of practical value, but it led directly to the type of present-day experiments which are indicating, according to some investigators, the nature of hypertension in the human subject (159, 174). There has long been an active interest in autonomic physiology among French and Italian investigators. Viale (14), using dogs, showed that the spleen is an organ which compensates readily for the rapid variations, slight or large, in arterial blood pressure, and he, together with Soncini (15), demonstrated that section of the vagus nerve causes the spleen of a normal dog to dilate greatly, which action does not occur in a dog when its spleen is denervated, and that the reaction of adrenalin, rapid and forceful on the normal spleen, is slight and slow in occurrence in the denervated spleen. Later, Reed and Layman (27) found that bilateral vagotomy in dogs resulted in a fall of the blood pressure, which might show various accompanying heart-rate changes, and they concluded that the post-vagotomy hypotension was partly due to the removal of the pathway by which impulses reach the vasomotor centers. DeGroat, Davis, and McDonald (45) produced hypertension in rabbits by the section of the vagi and denervation of the carotid sinus. This, they believed, was due to a resultant hyperepinephrinemia. Heymans and Bouckaert (33) reported that section of the carotid sinus alone in dogs produces a chronic hypertension with tachycardia and, occasionally, a fatal pulmonary edema. Danielopolu, Marcou, and Proca (32) showed that occlusion of the thoracic aorta causes a rise of the blood pressure measured in the carotid arteries due to an increased contractile force of the myocardium and occurring whether the coronary arteries are tied or not. However, a heart with ligated coronary arteries will not show a capacity for this reaction when the sympathetic fibers to it are interrupted, as, for instance, in the removal of the stellate ganglion. Thus, an altered myocardium does not readily tolerate the intervention of sympathectomy, and the authors explain that the accidents of acute myocardial insufficiency, following stellectomy in anginal patients, are due to the suppression of the nervous reserve. Danielopolu and Aslan (36), in contradistinction to Hering, did not find a tachycardia or hypertension when bilateral neurectomy of the carotid sinus was done with section of the centripetal "cardio-aortic" bundles. Leiter and Grinker (61), working with a large series of cats, found no evidence of a superior hypothalamic center for the control of blood pressure. Stimulation of any part of the hypothalamus produced no rise in the blood pressure when other factors, such as muscle action, were eliminated.

Thus, down to 1934, there was scattered evidence of serious work aimed at the discovery of the physiological basis of blood-pressure changes. Many of these efforts, not reported here, were completely misdirected, and the results eventually proved fallacious. However, the intent, the interest was established; arm-chair theorizing had for the most part stopped; and the collective results of the preceding years gave promise and support to experimentation on the cause of hypertension and its alteration by various surgical procedures on the endocrine and autonomic nervous systems.

There is no doubt that Goldblatt and his associates (58) gave the initial impetus to present-day animal experimentation when they began their study of the pathogenesis of hypertension by producing renal ischemia in dogs, as well as in monkeys (123), with a resultant sustained arterial pressure. This pressure elevation was at first considered to be comparable to the hypertension of human nephrosclerosis inasmuch as it was accompanied by uremia and disturbed renal function when constriction of the renal arteries was severe. Their method, remarkable for its ingeniousness, is now widely known and used. It consists of the partial occlusion, to any desired degree, of the renal arteries in dogs which have been trained to have blood-pressure readings made on previously prepared Van Leersum carotid loops. Small, adjustable silver clamps and a special instrument for placing them were developed especially for this study, and on the 11 original dogs so prepared the results were uniform and constant. Uremic symptoms and

death occurred only when there was sudden, severe, bilateral clamping of the arteries with a resultant high blood pressure. Less severe constriction of both renal arteries produced in every animal a permanent rise in the blood pressure, with a lowered urea clearance as the only indication of impaired renal function. The dogs lived many months. In 1 animal, removal of one adrenal with denervation and medullectomy of the other was done before the application of the clamps. Following arterial constriction, there was a prompt, persistent rise in the blood pressure. Not necrosis, but rather trophic change, was found in the glomeruli, parenchyma, and vessels of the kidneys of these animals. In this article, the first of a series of reports of further studies of renal ischemia, the authors pointed out that the injection of nephrotoxic substances, irradiation of the kidneys, and partial renal excision had all been tried without a resultant persistent hypertension. In subsequent reports Goldblatt postulated the existence of a "pressor" substance produced in and emanating from the ischemic kidney, thus placing the hypertension on a "humoral" basis. This argument has found many to support it, even among clinical investigators (82, 174), but others fail to see its justification, believing the pathogenesis of hypertension to be a much more complicated process (168).

Acceptable or not in all respects, Goldblatt's first reports represent the key experiments of most of the present animal experimentation on hypertension. Many workers are now using his method to produce and study hypertensive animals (79, 137, 120, 158, 153). Page (79), as well as Goldblatt (58), did not find the renal efficiency, as measured by the content of the blood urea, to be markedly altered in dogs with renal artery clamps, and he found that the renal efficiency bears no relationship to the height of the blood pressure. Furthermore, he found no significant changes in the plasma protein or lipoids. Freeman and Page (120) studied the peripheral resistance, cardiac output, and blood volume, as well as the part played by these factors in the genesis of hypertension in dogs prepared by the Goldblatt method. They found that complete sympathectomy (removal of the entire chain and all ganglia below the stellate) did not prevent the development of hypertension from compression of the renal arteries; that denervation of the heart combined with total sympathectomy did not influence the course of the hypertension; and that the plasma volume, in normal or sympathectomized dogs, was not increased as the hypertension developed. They concluded, therefore, that a renal ischemia type of hypertension is not mediated through an increase of the peripheral resistance of reflex sympathetic vasomotor origin, and that it is the result of neither a reflex change in cardiac activity nor an increase of plasma. Page and Heuer (81) had earlier denervated the kidneys in a young female patient with severe hypertension, and found no effect on her arterial pressure. This cast doubt in their minds on the rôle of the renal nerves in the genesis of hypertension. Since then Page (79, 157) and others (Collins, 88) have pointed out that the function of the renal nerves is not necessary for the development of hypertension, and, yet, the results of the large series of cases reported by Peet (82, 121, 174) are believed by him to be due mainly to the release of renal-vessel constriction of nervous origin by means of sympathectomy. Using dogs, Goldblatt, Gross, and Hanzal (125) found that excision of the thoracic portion of the splanchnic nerves and the lower four thoracic sympathetic ganglia, on both sides, does not prevent, cure, or permanently lower in any degree experimental hypertension produced by renal ischemia, and they stated that they believed, therefore, with Page and Collins, that such findings minimize the importance of the splanchnic vasomotor mechanism in the pathogenesis of renal hypertension. These findings were verified later by Alpert, Alving, and Grimson (111).

Grimson, Wilson, and Phemister (127), also working with dogs, found that in normal animals six months, on the average, were required for the blood pressure to rise to normal after complete sympathectomy (from the stellate ganglion above to the hollow of the sacrum below). Peripheral vascular tone during the period of lowered pressure was dependent, they believed, upon an inherent vascular tone and not on central vasomotor tone, as shown by cord section at the level of the eighth cervical segment. They found no evidence of an increase in inherent peripheral vascular tone synchronous with latent restoration of the blood pressure to the pre-operative level. Glenn, Child, and Page, (157) using dogs prepared with Van Leersum carotid loops and in which hypertension had been produced by the Goldblatt method, sectioned the spinal cord at the level of the fifth cervical vertebra, and then pithed the cord. There was an immediate sharp fall in the blood pressure, well below any former recording, and this was followed by a gradual rise to a level above the average pressure before the renal clamps were applied. At no time did the pressure rise to the previous average hypertensive level. In some dogs which lived as long

as sixty-one days after cord section, this post-pithing rise tended gradually to fall again.

Blalock and Levy (115) found that when hypertension is produced in dogs by partial occlusion of the renal artery of an explanted kidney, the removal of the kidney under local anesthesia usually results in a slow decline of the blood pressure. Partial constriction of the artery to a single remaining kidney, denervated and explanted into the neck, caused a rise of the blood pressure in their animals. These authors confirmed the findings of Page and Heuer (80, 81) in the human subject, and believe that the findings of Prinzmetal and Wilson (102)—that anesthetization of the vasomotor nerves does not release the vascular hypertonicity in renal hypertension—as well as the observations of Goldblatt and his associates (94)—that splanchnic section does not prevent the elevation of, nor lower, the blood pressure produced by renal ischemia—show that this type of hypertension is not dependent upon the integrity of those pathways or the renal nerves. Using normal dogs in which the blood pressures had been accurately established, Glenn, Child, and Heuer (156) transplanted the left kidney to the groin, keeping the ureter intact, and reestablished an arterial supply through the femoral arteries. This procedure alone caused no pressure changes. A right nephrectomy was then performed, also without effect on the blood pressure. The left femoral artery was then constricted by a Goldblatt clamp with a resultant rise in the blood pressure. These results indicate clearly that the renal nerves have no rôle in the initiation or maintenance of the hypertension of renal ischemia, and this report, incidentally, covers what was apparently a reliable and well controlled piece of experimental work.

Goldblatt and Wartmann (126) could not prevent or reduce the blood pressure in dogs suffering from renal ischemia by section of the anterior spinal roots from the sixth thoracic to the second lumbar, inclusive. McCann (170) agreed with Goldblatt in that he was unable to prevent, cure, or permanently lower the hypertension of renal ischemia by excision of the twelfth thoracic sympathetic ganglion and the thoracic splanchnic nerves. Goldblatt concluded that it is not likely that this type of hypertension is due to any nervous reflex from the ischemic kidney or to any portion of the vasomotor system other than in the kidney itself. This strengthened their view that the hypertension of renal ischemia is on a humoral basis, being produced by a hypothetical effector substance of renal origin which causes arteriolar constriction (124).

On all this good evidence that an ischemic kidney probably produces a "pressor-effector" substance, whereas a normal kidney does not, Leathem (166) attempted to discover the presence of this hormonal substance in the urine of hypertensive patients. Urine from male and female hypertensive individuals, controlled by normal urine, was injected into normal dogs. There was no difference in effect on the dogs, regardless of the source of the urine. Pickering (99) found that "the changes in arterial blood pressure produced in anemic subjects by transfusion of blood from patients with essential hypertension are very small," and that such changes are "no greater than those produced by transfusion of an equal volume of normal blood. This report is opposed to the idea that the raised blood pressure in essential hypertension is due to excess of pressor or deficit of a depressor substance in the circulating blood." These statements were the result of a large series of transfusions, some of the donors having pressures as high as 240/130 mm.

Page and Sweet (137), using dogs prepared by the Goldblatt method, reduced the pressure from 240/160 mm. to 150/100 mm. by hypophysectomy. They found no such response in normal dogs, and their results indicated that after hypophysectomy there is a reduction in the responsiveness of the blood vessels to chemical stimuli arising in an ischemic kidney. They raise the question, however, as to the possibility of the drop in pressure being due to a lack of adrenal or thyroid secretion. Glenn and Lasher (158) were unable to lower the hypertension of 8 dogs with renal ischemia by means of total thyroidectomy. Such a procedure seemed not to affect either the production or maintainance of this type of hypertension.

In view of the possibility of the formation of a pressor substance in the ischemic kidney and the further possibility that this substance might be modified or destroyed by passage through the liver, it seemed of interest to Child and Glenn (155) to determine the effect in experimental hypertension of the direct passage of blood from the ischemic kidney through the liver. The venous blood from the kidney, passing into the inferior vena cava, was shunted directly into the liver by means of an anastomosis with the portal vein. Two dogs in which this reverse Eck fistula was made had not yet had a hypertension produced by means of renal ischemia. Two other dogs had such a hypertension before the fistula was made. There was a slight elevation in the blood urea nitrogen for a few days in one dog postoperatively, but not in any of the others.

The production of hypertension was not prevented by the fistula, and the hypertension already established was in no way affected (179).

By the severe constriction of the renal arteries in 17 dogs, Goldblatt (159) was able to produce a malignant type of hypertension. There was a great increase in the blood urea, non-protein nitrogen, and creatinine of these animals, and the urea and creatinine clearance tests indicated a great reduction of renal efficiency. Some of the pressures went as high as 300 mm. systolic, with anal bleeding and blindness from intra-ocular hemorrhage. At autopsy many of the organs showed petechial hemorrhages or actual extravasation of blood with hyalinization and necrosis of the blood vessels. Goldblatt believes that elevation of the blood pressure, a mechanical factor, and renal insufficiency, a humoral factor, are at least two of the necessary conditions for the development of the necrotic arterioles and hemorrhages of malignant hypertension. "Necrotic arterioles and hemorrhages have not yet been observed in animals that have had a very high blood pressure for years without renal insufficiency, nor in animals with azotemia, due to the removal of both kidneys, but without hypertension. Hyalinized retinal arterioles have been observed in dogs with persistent hypertension and with moderate or no disturbance of renal function. That ischemia is not the cause of the necrosis of the arterioles is shown by their absence from the ischemic kidneys of the dogs and their wide-spread presence in the organs that were not ischemic . . . These experiments show that the necrotic changes and the hemorrhages are secondary to and not the primary cause of the malignant phase of hypertension." He also stated that the hypertensive kidney of man often does show arteriolar necrosis, but in dogs the intravascular pressure in the kidney is probably low because of the clamp, while in human beings it is high because of sclerosis and constriction of the preglomerular arterioles.

Through the continued efforts of Heymans and his co-workers (33, 74), as well as of several other French physiologists, there has been sustained an interest in the study of hypertension produced by denervation of the carotid sinus and destruction of the "cardio-aortic moderator" nerves. Working with dogs, Heymans and Bouckaert sectioned the depressor nerve to the heart and performed a neurectomy of the carotid sinus, and produced a hypertension which did not respond permanently to splanchnic sympathectomy alone, to adrenalectomy, or to lumbar ganglionectomy. They believed a complete removal of the sympathetic system to be necessary in order that such a hypertension be overcome. Davis and Barker (153) believe that such a hypertension may be similar to the occasional clinical case which presents a labile blood pressure, but that it does not correspond to the more common type of clinical hypertension. Green, DeGroat, and McDonald (73) denervated the carotid sinus and sectioned the vagus cardiac fibers in 9 dogs, with uniform results. Their operation was followed by an unstable increase in the blood pressure which gradually levelled off to slightly above the preoperative normal. Tachycardia resulted, as in Heymans' animals, and there was an occasional death from cardiac failure. They believed (72) that the failure of this hypertension to maintain itself was the result of an adaptation of the cardiovascular-sympathetic mechanism rather than a regeneration of the carotid sinus and aortic depressor nerves. Leriche (98) and his associates, producing hypertension in dogs by this method, were unable to lower the pressure effectively by total adrenalectomy, or by the removal of one adrenal gland and subtotal removal of the other. Pickering, Kissin, and Rothschild (101) agree with Davis and Barker in their opinion that the hypertension of patients in the "essential" group, or those suffering from nephritis, is different in origin from that produced experimentally by the method of Heymans and Bouckaert.

Hermann and Jourdan (128) reported that the stimulation of the cephalic end of the cervical sympathetic nerves of a dog causes the passage into the blood of a vasoconstrictor substance, the dog's adrenal glands having been decapsulated. The vagi were sectioned at the base of the skull and the lower cervical thoracic and lumbar cord was destroyed. Therefore, no sympathetic reflex through the cord was possible. Furthermore, the glomus caroticum was resected. The authors hold this study to be supportive of Cannon's old theory (1) of sympathin formation on sympathetic stimulation (147).

Lately some very significant experimental work has been turned out, furnishing results dealing with the rôle of adrenalin in hypertension apropos of certain current forms of surgical treatment of clinical hypertension. Prohaska, Harms, and Dragstedt (138) produced a sustained hypertension in dogs for as long as two weeks, by continuous intravenous injection of epinephrine. The amount sufficient to do this caused the death of the animals through a severely deranged metabolism following the hormonal effects of the treatment, and the authors therefore believed that it is not likely that a persistent hypertension

in man is due to hyperadrenalinemia. Rogoff, Marcus, and others (176, 177, 178) reported exhaustive quantitative studies on the output of epinephrine from the adrenal glands of dogs, and on its disappearance from the systemic circulation after the intravenous injection of various amounts. Their results support those of Dragstedt and his associates (138, 119). Rogoff found evidence against the probability of an autogenous continuance of adrenal secretion produced by circulating epinephrine. He found also that epinephrine disappears rapidly from the systemic blood when it is introduced into the circulation in amounts equivalent to those liberated by the adrenal glands under strong stimulation. "Unless it can be proved that there is an impairment in the capacity for removing epinephrine from the circulation in hypertension it is highly improbable, in the light of these quantitative observations (176), that hypersecretion of epinephrine by the adrenals and presence of epinephrine in the systemic circulation in concentrations capable of producing a persistent elevation of blood pressure can be the cause of chronic hypertension." Rogoff and his collaborators believe that many of the reports in the literature regarding the amounts of epinephrine in the circulating blood of hypertensive individuals are grossly exaggerated and calculated by improper methods of assay. In dogs suffering hypertension from renal ischemia they found no increase of epinephrine, and they point out the fact that Goldblatt (58), in his early experiments, was able to produce chronic hypertension by renal ischemia in dogs after the excision of one adrenal gland and the denervation of the other, with mechanical destruction of the medulla. Such hypertension, therefore, must be independent of the secretion of the adrenal glands (147).

However, Goldblatt later reported (124) that bilateral adrenalectomy eliminates completely the response to constriction of the renal arteries, and found evidence to indicate that the cortex of the adrenal glands was necessary to the development of the hypertension. He believed there was a definite relationship in which cortical secretion and the hypothetical renal "effector" acted together to produce and maintain the hypertension. These results were later confirmed and amplified by Page (172), who showed that the adrenal cortex or the administration of its extract in substitution therapy was necessary for the production and maintenance of the hypertension of renal ischemia. Page further showed that hypophysectomy may decrease the vascular response to the constriction of the renal arteries, but it does not prevent hypertension even in the absence of replacement treatment. In 4 experiments, the removal of the gonads in either male or female dogs did not appear to modify appreciably the hypertension once it was established.

Walter and Pijoan (141) produced a pressure of 242/130 mm. in a dog, persistent for many months, by nicking the posterior hypothalamus. They found no retinal changes of loss of elasticity of the vessels as shown by nembutal anesthesia. This hypertension was obviously of a more labile type than that of dogs with renal ischemia.

THE NATURE OF HYPERTENSION IN HUMAN SUBJECTS

Hypertension may be produced in animals in a number of ways, but the question has been: "How can the results of animal experimentation be evaluated so as to elucidate the cause and treatment of hypertension in human beings?" The importance and difficulty of this correlation is voiced by several modern investigators (133, 167, 143). Karsner states (164) that the observations in experimental animals and in man from the clinical side give no support to the view that "essential" hypertension is different from "renal" hypertension. He believes that degenerative processes are to be found in any and all hypertensive subjects.

The complete pathological picture, as well as the cause, of hypertension still remains unknown in human hypertensive individuals. The importance of this knowledge was emphasized by Keith and Kernohan (23) as early as 1930. The effect of animal and vegetable diet on the blood pressure of man was studied by Saile (28), who observed various orders of monks whose diets varied according to their rules, but he was unable to reach any definite relationship between diet and blood pressure. Lhermitte (24) believed that he recognized a case of hypertension in a patient with an inflammatory lesion of the gasserian ganglion, which was due to the involvement of the hypothalamic and brain-stem vasoconstrictor centers through the ascending and descending pathways of the fifth nerve. Raab (41) gave experimental and clinical data to indicate that a possible cause of either essential or arteriosclerotic hypertension is a vascular disturbance of the cerebromedullary vasomotor centers following atherosclerosis, arteriosclerosis, and, perhaps, spasms of the basilar blood vessels and their branches. Spark (83) found no morphological evidence to support the hypothesis that essential hypertension and the hypertension of eclampsia gravidarum are due to a hyperactiva-

tion of the neurohypophysis by an increase of basophilic cells. In post-mortem studies of a large series of patients in which there were 70 with essential hypertension, 11 with an antecedent hypertension and 108 with no hypertension, there were no differences in degree of basophilic invasion of the pars nervosa when groups of the same ages were compared. In 1934 Cushing (55) reported several cases of hypertension with marked pituitary basophilism. In eclamptics he had found anterior-lobe basophilism with an overflow of basophils into the posterior lobe. Leary and Zimmerman (132) concluded after a study of the pituitary glands in 153 cases that "significant" basophilic infiltration is much more common in hypertensive than in non-hypertensive patients, and more common after the age of forty. Pickering and Kissin (100), contrary to the belief of the DeCourcy Clinic (70), concluded that patients with chronic nephritic hypertension were not abnormally sensitive to circulating adrenalin, and they found no evidence to support the view that essential hypertension is due to hyperadrenalinism. They confirmed, therefore, the more recent reports of Dragstedt, Rogoff, and their associates. Further examples of disagreement as to the rôle of the adrenal glands could be cited.

American surgeons, while attempting to determine the cause of hypertension, are immediately concerned with the employment of reliable criteria for the selection of cases for surgical treatment. This need has been repeatedly voiced by surgeons at the Mayo Clinic (86), by Leriche (168), and recently by Davis and Barker (153). An agreement has not yet been reached as to what constitutes a reliable method for the determination of cases suitable for surgical care. Even hypertension itself is not defined alike by all, and although classifications (21, 130, 134, 160) have been attempted, they have failed to clarify the origin or nature of the syndrome of hypertension. Livingstone (78) accepted 150/100 mm. as the highest pressure which could be considered normal. According to Davis and Barker (153) essential hypertension is a disorder with one or more etiological factors, in which the blood pressure is over 160 mm. systolic and 90 mm. diastolic. DeCourcy (57) compared hyperthyroidism to hyperadrenalinism, i.e., hypertension, which he believes is due to an overactivity of the adrenal glands, and he bases his treatment accordingly. Crile (151) recently defined essential hypertension as a "pathologic physiology of the mechanism that governs the diastolic and the systolic blood pressure," and he considers it primarily a "pathologic physiology" of the aortic complex and celiac ganglia (118). Brown (68) voiced the general belief of the Mayo Clinic group when he stated that essential hypertension is on a neurogenic basis, that it is a manifestation of exaggerated vasomotor response, and that 85 per cent of the patients suffering from essential hypertension have a familial history of the complaint. Peet (82, 174) agrees that essential hypertension is neurogenic in origin.

THE FORMS OF SURGICAL TREATMENT

Following the early investigation of Jean (2,3), Danielopolu (4), Pende (5, 7), Bruening and Stahl (6), Rowntree and Adson (8), and Pieri (9, 40), there has been a constantly growing interest in the possibilities of the surgical treatment of hypertension among continental European and American surgeons. This interest, sustained by encouraging results in the research laboratories, is keen and active because of the increasing importance of hypertension among the more formidable disease entities and because of the high mortality it produces in spite of the best medical care. But surgeons have met with repeated warnings and criticisms from those who would continue with the conservative measures of rest, re-education in living habits, and medication (19, 25, 29, 46). Wilson (142) stated in 1937: "The most important factor in the prognosis and treatment of hypertensive disease is not the height of the blood pressure, either systolic or diastolic, but the degree of arteriolar and arterial sclerosis especially in the coronary arteries, and in those of the cerebral and renal areas, and the consequent dysfunction due to oxygen and nutriment deprivation. . . . Treatment directed chiefly toward the reduction of the blood pressure consequently does not rest upon a reasonable basis, and may be harmful."

There are innumerable reports in the literature of hypertension cured by means of the removal of adrenal tumors (12, 26, 20, 42, 67, 51, 62, 145, and others), but this type of hypertension is paroxysmal and not to be confused with the commoner, less well understood "essential" and "malignant" types of the symptom. In the presence of our lack of understanding of the cause and nature of either form—and it is obvious from the various conflicting reports that this is so—and because there has never been a general acceptance of criteria on which to select patients for surgical treatment, the measures employed have been varied to the extreme, often unwarranted and irrational, and in some instances based on little or no reliable clinical or research data.

Garot (10), of the University of Liège, did not find that ultraviolet radiation had any manifest action on the blood pressure of infants. He cited his negative results in the face of reports from others that ultraviolet rays exert a hypotensive effect on the blood pressure. Henriques (11, 17) applied radium over the temporal area in order to reach the basal ganglia and thus lower the blood pressure of his patients. Critics pointed out at the time of his report that such a method was without scientific or rational basis, and the wonder is that such a peculiar form of therapy was ever conceived. Henriques offered no explanation of the rationale of his treatment, but time and results have proved the fallacy of such a procedure. Bisset (22) reported a series of 62 patients suffering from hypertension whom he treated with rectal douches of sulphur water on the reasoning that the solution was bactericidal and the removal of "pressor substances" from the colon might thus be effected. His results were not startling. On the theory that pituitary and/or adrenal hyperfunction or dysfunction causes hypertension, Hutton and his associates (59, 152) have made several reports of patients treated by the application of x-rays over the pituitary and adrenal areas, and they report that treatment has been effective in 75 per cent of their cases of essential hypertension in that symptomatic relief was obtained whether or not there was a fall in the pressure. These results, however, do not seem to enjoy popular acclaim. Chabanier (87) reported the effective lowering of the blood pressure in patients with hypertension and glomerular nephritis by decapsulation and denervation of the kidneys.

The past three years have seen a decided turn away from so much diversity of thought, theory, and surgical attempt. The state of complete agreement between surgeons as to what constitutes the optimal surgical treatment lacks much of its ideal attainment, but clinical and animal research is more and more being directed in such a way as to narrow the line of attack, and concerted action by large groups of surgeons brings out monthly greater promise of relief for the hypertensive patient. "Modern" surgical treatment, according to the trends both in America and abroad, may be classified under three types of operation: rhizotomy, adrenalectomy, and sympathectomy. All other current forms of surgical treatment are greatly in the minority, and they are receiving little notice because of lack of support by either clinical results or experimentation in the laboratory. Even rhizotomy, used in this country only a few years ago, has already been discarded by most of its former adherents.

Rhizotomy. Because the results on the blood pressure and the ultimate outcome following removal of lumbar ganglia Nos. 2, 3, and 4, with the intervening chain, were not significant, Adson (8) believed that not a large enough area had been denervated. So in order to secure complete sympathectomy below the diaphragm he performed, in 1930 (48), a bilateral section of the anterior and posterior roots, from the sixth thoracic to the second lumbar, inclusive. The pre-operative pressures were not given, but post-operatively the pressure ranged from 140 mm. to 160 mm. systolic and from 80 mm. to 110 mm. diastolic. There was a complicating postoperative hemorrhage which caused cord changes and masked the physiological results of the sympathectomy. In the report of a case of hypertension treated by anterior rhizotomy from the sixth thoracic to the second lumbar roots, inclusive, the pressure was said to fall from 240/165 mm. pre-operatively to 180/125 mm. after the root sections. There was no sweat response below the substernal notch, but there was still some response to the "cold pressor" test below the diaphragm. Adson (48) was encouraged by this result, believing that it demonstrated the necessity of paralyzing the anterior abdominal wall to reduce the intra-abdominal pressure. Brown, Craig, and Adson (69) reported later a series of 8 cases treated by bilateral anterior rhizotomy from the sixth thoracic through the second lumbar roots, with an effective, permanent depression of the blood pressure. In fact, the upright posture caused such a terrific sudden drop that abdominal binders were necessary in some cases. Leriche frankly criticized such "debilitating and mutilating" operations, and saw no point in "curing a disease by crippling the patient." Page and Heuer (95, 136, 130, 171) reported on a series of 20 patients treated by sections of the anterior roots whose conditions varied from benign essential to almost highly malignant hypertension. They considered abnormal vasospasm, particularly of the splanchnic arterioles, to be a more important cause of hypertension than either hypophyseal basophilism or hyperadrenalinism. The operations in this group of patients were attended by three severe complications, including two deaths. Heuer found that anterior rhizotomy did not produce more than a 25 per cent reduction of the pre-existing pressure, possibly because of the variability of the severity of the disease in different individuals. He found that in some cases the pathology about the eye cleared up very

well and the heart decreased in size, but that the renal function was not changed. In the selection of cases several criteria were used. The flexibility of the vascular tree was determined by the fall in the blood pressure when the patient was put to bed, by the fall of pressure after the intramuscular injection of colloidal sulphur or of acetyl-beta-methylcholine, after the administration of sodium thiocyanate by mouth, or after the inhalation of amyl nitrate, and especially by the daily fluctuations in the level of the blood pressure as determined by a long period of observation. Evidence of cardiac and renal damage, as well as fundus changes, were used to determine the degree of advancement of the hypertension. Heuer (95) placed little significance on the paralysis of the anterior abdominal muscles, and found the abdominal enlargement neither unsightly nor disabling. Page (171) felt that the best results were obtained in malignant hypertension and that essential hypertension could still be best treated medically.

A procedure comparable in result to anterior rhizotomy was done by Abelson (47) for the relief of hypertensive crises when apoplexy was imminent. This was the injection of normal salt solution around the anterior roots, outside of the arachnoid, the effects of which might last several days.

Adrenalectomy. On the assumption that hypertension is the result of the over-activity of the adrenal glands, the partial removal of the normal organs has been practiced by various foreign surgeons, mainly French, and by the DeCourcy Clinic in Cincinnati.

Galata (16) removed one suprarenal gland in a woman suffering from a "menopausal hypertension" and secured a drop in pressure from 280/150 mm. or 300/160 mm. to 180 mm. or 190/100 mm., which was still present with subjective improvement at the end of six months. Meillère and Ollivier (63), in a review of current trends in the treatment of hypertension, were impressed by the effort concentrated against the adrenal glands or against their secretory nerves, looking with favor on subtotal adrenalectomy rather than on denervation of the gland, but they warned of the dangers of such interference with the vital organs. They believed DeCourcy's partial bilateral adrenalectomy to be the operation of choice for malignant hypertension. They reported earlier (65) that the partial removal of the adrenal glands for essential hypertension was dangerous, ill-advised, and without results sufficient to warrant the risks incurred. Langeron and his associates (60) believed surgical treatment to be warranted only when the pathological seat of the hypertension could be removed, and encouraged adrenalectomy if a tumor were present or if hyperactivity or hyperplasia of the gland could be demonstrated. They warned particularly against a sudden operative drop in the pressure. Monier-Vinard and Desmarest (64) reported 2 cases of far advanced hypertension treated by complete removal of the right adrenal gland, with improvement subjectively and clinically. The reports were made at the end of one year and four months respectively, and both cases had had extensive pre-operative study so that the organic changes present were well recognized. Leriche, Hermann, and Martin, P. E. (76) treated a case of malignant hypertension unsuccessfully by unilateral adrenalectomy, even though the gland showed hyperplasia. The same year Leriche and Ravault (77) reported that the removal of a normal left suprarenal gland in a patient suffering from an advanced essential hypertension resulted in a "permanent" cure. The pressure averaged 250/145 mm., cardiac changes had occurred, and there were marked subjective complaints, all of which were relieved by the operation. Here, as later (168), Leriche stated that he believes the solution of the problem of hypertension lies in the eventual understanding of the hormonal (adrenal) factor, and that clinical, rather than animal, experimentation will bring about the solution. His best results have been obtained by unilateral adrenalectomy and lumbar ganglionectomy on the same side, at one stage, followed later by a splanchnic resection on the other side, with or without ganglion ablation. Leriche (169) reported early in 1938 a case of hypertension treated with left splanchnicectomy and left total adrenalectomy, in which the pressure fell from 200/120 mm. to 160/90 mm. with good subjective results which were still present after fourteen months.

In an early report (57) DeCourcy compared subtotal thyroidectomy for hyperthyroidism to bilateral subtotal removal of the adrenal glands (in two stages) for hypertension. He believed actual removal of the tissue was necessary because of the presence of adrenal hyperplasia and hyperactivity, and therefore believed that splanchnicectomy alone, or adrenal denervation, was ineffective. He was criticized by Ayman (49) because of the shortness (one week) of his preoperative period of observation of his patients. By August, 1934, DeCourcy (56) had operated upon 8 patients "for the relief and cure of essential hypertension." In all of the cases the operation was done under spinal anesthesia, in

two stages, through a kidney incision, and about one-fourth of each gland was left. He accounted for the drop of from 70 to 90 points systolic and from 40 to 50 points diastolic by the removal of hyperplastic medullary tissue, which under constant sympathetic stimulation poured excessive amounts of adrenalin into the blood. He reported no complications. In 1935 he stated (70) that it was an "accepted fact" that essential hypertension is due to the increased adrenalin content of the blood, and he postulated that in those cases in which the pressure rose again postoperatively it was due either to a regeneration of the adrenal glands or to accessory pheochrome tissue masses elsewhere in the body. He believes (71) that the cases chosen for adrenalectomy require an *early* diagnosis, and that this can be made by means of fundus examination, study of the blood chemistry, and tests of the renal function. If there is any alteration in the eye grounds, a considerable drop in the renal function, or pathological changes in the blood chemistry, he does not operate. His operations are done from two to three months apart, and during the interval a compensatory hypertrophy is believed to occur in the gland, which is subtotally removed at the second operation. From one-fourth to one-fifth of each gland is usually left, which amount he believes is within the limit of safety. He points out that at this same operation the gland can be denervated if its capsule is stripped to the hilus and the nerves which are thereby laid bare are cut.

Sympathectomy. The best clinical results which are being obtained at the present time, judging by reports, follow one of several types of sympathectomy. This may be adrenal denervation by "celiectomy," as done by Crile, or by splanchnic nerve resection ("operation of Pende"), as practiced by Peet, the Mayo Clinic, and others.

Crile is the outstanding advocate of celiectomy for the treatment of hypertension (89, 90, 91, 118, 149, 150, 151). Much of the argument for his form of treatment is based on conclusions drawn from comparative anatomical studies; much of it is teleological; and much of it is not accepted as sound or rational by his critics. He stated that "it is known that in essential hypertension there is no demonstrable pathologic change in any organ or tissue except such as arise as a result of the disease, in particular, those in the blood vessels, the heart, and the kidneys. That is, essential hypertension is not caused by a pathologic morphology. It must then be due to a pathologic physiology, and the only tissue in which a pathologic physiology can be developed is nerve tissue. Essential hypertension, therefore, must be due to a pathologic physiology of that nerve tissue which is chiefly directly concerned with the control of the diastolic and systolic pressure and the force of the heart beat, which means that part of the sympathetic complex most immediately related to the arterial tree, namely, the aortic complex and the celiac ganglia." Early in his surgical treatment of hypertension he, too, practiced adrenalectomy, but he found that it alone was not effective and that the adrenal sympathetic mechanism, which also has to do with the circulatory rate of the blood, must be attacked as the source of the disease. He looks upon the adrenoceliac-aortic complex as the "energy-controlling system" of the body, and believes that the purpose of celiectomy is to depress the function of this system.

Crile's operation consists of a lumbar incision, with insertion of the hand down to the aorta. The field of operation is not visualized, but instead a "touch anatomy" is used to locate the desired ganglia and their nerves, which method provides "a three dimensional value and a certainty of identification which is not possible by sight and instrumentation." He believes visualization is not feasible, and in his operation, which requires from fifteen to twenty minutes, blunt finger dissection is used to free the celiac ganglia and aortic nerves.

By June, 1938, he had performed 398 such operations on 233 patients suffering from essential hypertension. One year or more after surgery 87 per cent of the patients are relieved and 35 per cent have complete relief. Of 15 cases of malignant hypertension, 75 per cent show favorable results after one year. Malignant hypertension was found to be no contra-indication to surgery, since there was nothing to lose by operation and the prognosis was poor under any treatment. The one important result of operation, to Crile, is a betterment of the patient's *subjective* complaints. Increased diastolic pressure, changes in the eye ground, a drop in the kidney function, and the patient's story of his disability and distress are the most valuable indications by which essential hypertension can be diagnosed. Sclerotic changes are no criteria. The age of the patient, the duration of the disease, the condition of the heart, and the good or bad effects of sedation never constitute, under any conditions, contra-indications to celiac ganglionectomy, but impaired kidney function may, in some cases, be a contra-indication to operation. Crile believes (150), in disagreement with Leriche (96), that a diagnostic novocaine block of the splanchnic nerves is a dangerous procedure.

Rogoff and his co-workers (176, 177, 178) decry the employment of such radical surgery. They warn of the dangers of adrenal insufficiency in any "tampering" with the adrenal glands. Roentgen treatments to the adrenal glands are definitely dangerous. With regard to irradiation of the hypophysis, as well as of the adrenals, they point out that if it is assumed that an interrelated function between the hypophysis and the adrenal medulla is involved in such therapy, it is without any experimental or clinical proof, and that the experimental basis for intervention at the hypophysis in the treatment of hypertension is even less substantial than intervention at the adrenal glands.

Of interest in connection with the Crile operation is the observation of Ivy (163) that "to those who would denervate the adrenals for the treatment of various diseases, the report (131) that the adrenal nerves of cats regenerate in four months, even after the removal of the lower thoracic and upper lumbar sympathetic chain, will be of interest."

Surgery having to do with removal of the splanchnic nerves and the lower thoracic and upper lumbar chain, with or without an attack on the suprarenal glands, has been given serious trial for several years; and, in spite of poorly controlled clinical experiments, occasional reports of questionable authenticity, and adverse criticism by many internists and surgeons, this form of surgical attack on the problem of hypertension is rapidly growing in popularity; and if one may judge by the results stated in the reports, it is offering more hope for a solution, on a sounder physiological basis, than any other form of surgical therapy yet devised.

This operation is usually credited to Pende (5, 7), but it was first suggested in 1923 by Danielopolu (4). Basing his action on the influence of the splanchnic nerves on the secretion of the suprarenal glands, shown by him on animals since 1903, and on the vasoconstrictor action of the splanchnic nerves in the abdominal vascular tree, Pende proposed, in 1924, a surgical treatment for hypertension which consisted of interrupting two links, the nervous and the hormonal, in the supposed pathogenic chain, i.e., hyperexcitability of the splanchnic nerves and exaggeration of the adrenal secretion. This work was reviewed by Santucci (43), who on his own records stated that up to that time (1932) Pende's operation had proved the most efficacious form of surgical treatment. In answer to the ever-present question of whether it is safe and physiological to lower the blood pressure of hypertensive patients, Santucci answered emphatically in the affirmative. Pieri (9, 40) was among the first to develop the technique of section of the splanchnic nerves, together with lumbar ganglionectomy. Pieri's operation of left-sided splanchnicectomy was later criticized by Adson as valueless because the adrenal glands were thereby incompletely sympathectomized. Meillère and Ollivier (63) in a long and comprehensive review of the French literature indicate that the adrenal factor is considered of prime importance in the treatment of hypertension, and the interest of French surgeons has mainly centered around ways and means of decreasing the adrenal function. These two investigators believe that celiectomy is probably more effective, but they favor splanchnicectomy because of its relative ease of accomplishment, not overlooking, also, the good results obtained by splanchnicectomy. Durante (37) likewise advocated the Pende method. Pereira (18) reported that Pieri resected the tenth, eleventh, and twelfth ribs in order to perform an intrathoracic, posteromediastinal splanchnicectomy. Rossi's technique (13) was much the same. It was Pereira who proposed subdiaphragmatic section of the splanchnic nerves in order to avoid the dangers associated with the thoracic cavity and mediastinum. Baumgartner and Harvier (113), following the original technique of Pende, sectioned the left splanchnic nerves in a fifty-two-year-old woman with a true essential hypertension. A fall of pressure from 260/130 mm. to 170/110 mm. was effected for two weeks, but then the pressure rose to its original height. Hypophyseal and adrenal irradiation did not affect her. The authors point out Tournade and Chabrol's demonstration that each of the adrenal glands is bilaterally innervated and that therefore unilateral section is useless. Hermann and Sabadini (129) believed that no more than a temporary lowering of the blood pressure was ever obtained by even bilateral splanchnicectomy. Hermann and his group (161) reported in 1938 that while working with dogs they obtained proof that Pende's unilateral operation never was justified, and that they see no reason for the choice of either side alone. They believe that any splanchnic resection is poor surgical treatment and favor adrenal resection to adrenal denervation in any form, although they do not state that they have found hyperadrenalinism to be a cause of permanent hypertension. Ciceri (116) is a staunch supporter of Pende's original principles, except that he uses the technique of Donati, which is a lumbar, subdiaphragmatic, extraperitoneal approach to the splanchnic nerves. In reviewing its

adoption, he points out that Pende's operation is used, with modifications, in Italy by Pieri, Durante, Donati, Ciceri, Stropini, Mingazzini, Alessandri, Valdoni, and Paolucci; in America by Peet, Adson, Craig, and others; in France by Camolat, Langeron, Vincent, Desorcher, Fontaine, Leriche, and Jeanneney; and in Roumania by Janu. Ciceri does not agree with the criticism of Hermann (129, 161); he believes the operation is justified if sustained by clinical results, regardless of any animal experimentation. Leriche (168), however, is not entirely willing to accept splanchnicectomy; he believes the pathological basis of essential hypertension will be found in abnormal adrenal function, and discredits the value of the application of Goldblatt dogs to human hypertension.

The American literature contains a great many reports of small series of cases of hypertension treated by sympathectomy alone, in combination with other forms of neurological approach, and by nephrectomy (75, 85, 103, 139, 114, 140, 122, 153, 144, 162, 146, 165). Naturally, the results in so many different hands have varied widely. The two largest American series are those of Peet and the Mayo Clinic, whose results have become increasingly full of promise. Whether one will accept or refuse the arguments for the surgical treatment of hypertension, one cannot fail to be impressed by these large series of cases, by the surprisingly good results, and by the apparent honesty of the reports.

Peet (82, 93, 121, 173, 174) was the first man in America to do a bilateral intrathoracic resection of the splanchnic nerves for hypertension, and his present technique varies but little from his original method. Through paravertebral incisions a small portion of each eleventh rib is resected, the pleura retracted, and the sympathetic chain, ganglia, and splanchnic nerves are identified. The lower few centimeters of all three splanchnic nerves are resected, and the chain and ganglia from the tenth ganglion downward to the diaphragm are removed with sectioning of the rami from the tenth, eleventh, and twelfth intercostal nerves. Both sides are done at one sitting, the entire operation requiring about one hour. The series of Peet and his associates now totals more than 400 cases, some of them showing a persistence of clinical cure or great amelioration of symptoms for as long as five years.

This investigator is greatly impressed by the implications of Goldblatt's studies. He is convinced that the majority of his cases of hypertension have been due to an ischemia of the kidneys secondary to persistent vasoconstriction on a neurogenic basis, and he believes his good results have been obtained because, by sympathectomy, nervous overactivity has been depressed—the "nervous clamp" has been removed from the renal vessels. He recommends surgical intervention when the patient is fifty years old or younger, the systolic pressure is 200 mm., the non-protein nitrogen not over high normal, urine concentration 1.010 or over, the urea clearance above 30 per cent, the heart still compensated, and the patient has the clinical signs of headache, vertigo, weakness, and failing vision. Medical treatment having been tried, he believes that surgical intervention may be imperative if ocular changes are advancing and cerebral and cardiac damage is imminent. He has found no test which preoperatively will definitely indicate a permanent lowering of the blood pressure after splanchnicectomy. He has found that renal efficiency is not harmed by splanchnicectomy, in contradiction to the "compensatory theory" of renal function in hypertension, but on the contrary, many cases have shown improvement or complete return to normal in renal efficiency after operation. In these conceptions he is supported by other reliable investigators (66, 81). In brief, Peet's purpose in the surgical treatment of hypertension is to lower the blood pressure, improve renal function, and give the patient symptomatic relief by (1) diminishing the peripheral blood volume through splanchnic dilatation, (2) diminishing the adrenal function, and, especially, (3) abolishing abnormal vasoconstriction effects on the kidney provided sclerotic changes in the kidney are not already too far advanced.

Surgeons and internists alike at the Mayo Clinic have been prolific and for the most part enthusiastic in the reports of their experiences in the surgical treatment of hypertension (8, 38, 46, 48, 53, 52, 54, 68, 69, 84, 86, 96, 105, 106, 107, 108, 117, 109, 110, 148, 144, 143). Beginning with a trial of the original Pende operation, then rhizotomy, and then a gradual development of their present technique, their history in this field of therapy is one of persistent effort and optimism. The operation which is practiced at present and advocated by Adson, Craig, and other surgeons of the Clinic staff consists of a subdiaphragmatic, extraperitoneal, bilateral resection of the splanchnic nerves and a removal of the upper two lumbar ganglia with the intervening chain. This procedure, they believe, completely denervates the splanchnic vessels, the adrenal glands, and the kidneys. Their series is now a large one—somewhat less than that of Peet, however—and they have on record patients who

are enjoying relief from symptoms for more than three years after operation.

The Mayo group accepts the neurogenic theory of the cause of hypertension, believing the syndrome to be due to a hypersensitivity of the vasomotor mechanism in certain individuals. The purpose of their operation, therefore, is to block the vasospastic impulses to the splanchnic area and to dilate the splanchnic vessels so as to create a safety reservoir when vasoconstriction occurs elsewhere; to decrease the liberation of epinephrine; and to increase the renal blood supply. They have been concerned especially with the problem of the proper selection of cases for surgical care, and various pre-operative procedures have been put to use. Hourly blood-pressure readings are taken for twenty-four hours with the patient at bed rest; the effect of sodium pentathal given intravenously, and of sodium amytal and sodium nitrate given orally is noted; and the effects of spinal anesthesia and avertin have been studied. A test very much in favor is the so-called "cold pressor" test, first described by Hines and Brown (38, 68, 96), and later criticized by Pickering (100) and Reid and Teel (175). They realize that no one criterion is absolutely reliable, and Adson has remarked that the cases giving favorable results pre-operatively very often are the ones showing the less satisfactory operative results. Sequelæ of their operation may be the loss of sweating on the feet and lower legs, permanent increase of the skin temperature on the lower extremities, paralysis of the ejaculatory powers due to a weakness of the muscles of the urogenital trigone, and sterility in the male without loss of libido. There is no alteration in menstruation or in childbearing function, and no sphincteric disturbance occurs in either sex.

In contradiction of Wilson's (142) remarks, Adson and Allen state: "Failure of attempts to lower the blood pressure of patients who have hypertension has led to faulty reasoning and to explanations as to why the blood pressure should not be lowered in cases of hypertension. . . . As we shall demonstrate later, it is not dangerous to lower blood pressure in cases of hypertension; in fact, such an accomplishment is highly desirable." Later they stated: "The failure of sympathectomy to lower blood pressure uniformly in any case of hypertension indicates that sympathetic control is not removed from a sufficiently large vascular bed by extensive sympathectomy, that the blood supply to the kidneys is not increased adequately, or that some mechanism inherent in the arterioles is responsible for the elevation of the blood pressure."

Allen and Adson (143) recently answered some current objections to the surgical treatment of hypertension in the light of their own experiences. They cannot correlate the experimental data obtained from the study of Goldblatt dogs with the information known concerning the pathogenesis of human hypertension. They state, further, that there is no clinical evidence to indicate that those parts of the body not influenced directly by sympathectomy, as the heart and brain, suffer a diminished blood flow after splanchnic dilatation. In fact, the retinal vessels show a marked improvement. There is no clinical evidence, either, that structures in the area dilated have to continue to function in a state of hyperemia. They flatly refute the evidence of Prinzmetal (102), that there is no increase in the vascular tone in hypertension, that the hypertonus is inherent in the vessels themselves, and that the hypertonus does not result from an overactivity of the sympathetic nerves. Their clinical results indicate the exact opposite. They operate to reduce the pressure by dilating a large splanchnic reservoir, not to denervate the local splanchnic area as a specific area in need of sympathectomy. They realize the fact that their results have not yet withstood the test of adequate time, but they have been encouraged by them enough to insist that the surgical treatment of hypertension deserves unbiased consideration and further trial.

CONCLUSION

The present day marks a critical stage in the treatment of hypertension. Some reviewers apparently do not deem surgical treatment of hypertension worthy of mention (25, 30, 35); others (19, 31) question the validity and worth of some of the published reports (a point no doubt well taken!); some (29, 39, 104) look charily at any operation for the relief of hypertension until the pathological basis for the condition is found; and still others (112) report the use of medical treatment alone, or in combination with surgery (153), with apparent success. The inadequacy of pre-operative and postoperative observations (95) and the desperate lack of criteria for the selection of cases is voiced by many earnest investigators (153). Some surgeons are experiencing uncertainty and distrust of most of the current theories of proper treatment (92, 140, 154, 168). Even definition and differentiation of "essential" and "malignant" hypertension have not been attained (160).

It is obvious, then, from the numerous and conflicting reports, that concerted action cannot be put into play and the optimal results from the

surgical treatment of hypertension cannot be expected until clinicians accept a common definition for the types of hypertension, conduct their clinical investigations in the same way they would conduct carefully controlled laboratory experiments, find suitable criteria for the selection of patients, and perform their favorite operation only when it is on a sound physiological basis. It is true that the nature of hypertension presents one of the most difficult problems in all medical endeavor, and the difficulties in its solution, no doubt, account for the multiplicity of ideas and therapeutic measures which have been reported. However, a complete understanding of the pathogenesis and treatment of hypertension will come, not through a greater volume of work done, but through meticulously managed investigation, both clinical and experimental.

BIBLIOGRAPHY

1911

1. Cannon, W. B., and de la Paz, D. Am. J. Physiol., 1911, 28: 64.

1921

2. Jean, G. Lyon chir., 1921, 18: 339.
3. Idem. Arch. de méd. et pharm., 1921, 111: 292.

1923

4. Danielopolu, D. Bull et mém. Soc méd. d. hop. de Par., 1923, 47: 778.
5. Pende, N. New York M. J., 1923, 118: 469.

1924

6. Bruening, F., and Stahl, O. Die Chirurgie des vegetativen Nervensystems. Berlin: Julius Springer, 1924.
7. Pende, N. Atti d. XXX Cong. di medicina interna, Milano, 1924.

1925

8. Rowntree, L. G., and Adson, A. W. J. Am. M. Ass., 1925, 85: 959.

1927

9. Pieri, G. Ann. ital. di chir., 1927, 6: 678.

1928

10. Garot, L. Compt. rend. Soc. de biol., 1928, 98: 871.
11. Henriques, A. New Orleans M. & S. J., 1928, 80: 647.
12. Langeron, L., and Loheac, P. Presse méd., Par., 1928, 36: 1153.
13. Rossi, F. Arch. ital. di chir., 1928, 21: 729.
14. Viale, G. Compt. rend. Soc. de biol., 1928, 99: 1437.
15. Viale, G., and Soncini, J. M. Compt. rend. Soc. de biol., 1928, 99: 1438.

1929

16. Galata, G. Arch. d. mal. du coeur., 1929, 22: 722.
17. Henriques, A. Radiol. Rev. & Chicago Med. Rec., 1929, 51: 97.
18. Pereira, A. Nervi Splanchnici. Porto, Portugal: Tipografia Porto Medico, Ltd., 1929, p. 331.

1930

19. Ayman, D. J. Am. M. Ass., 1930, 95: 246.
20. Barker, L. F. Med. Clin. North Am., 1930, 14: 265.
21. Bellamy, W. A. Med. Press, 1930, 130: 491.
22. Bisset, A. A. Practitioner, 1930, 124: 241.
23. Keith, N. M., and Kernohan, J. W. Ann. Int. Med., 1930, 4: 217.
24. Lhermitte, J., Trémolières, F., and Véran, P. Bull. et mém. Soc. méd. d. hop. de Par., 1930, 54: 1148.
25. Palmer, R. S. New England J. M., 1930, 203: 208.
26. Porter, M. F., and Porter, M. F., Jr. Surg., Gynec. & Obst., 1930, 50: 160.
27. Reed, C. I., and Layman, J. A. Am. J. Physiol., 1930, 92: 275.
28. Saile, F. Med. Klin., 1930, 26: 929.
29. Weis, S., and Ellis, L. B. Am. Heart J., 1930, 5: 448.
30. White, J. C. New England J. M., 1930, 203: 226.

1931

31. Ayman, A. J. Am. M. Ass., 1931, 96: 2091.
32. Danielopolu, D., Marcou, I., and Proca, G. Compt. rend. Soc. de biol., 1931, 107: 854.
33. Heymans, C., and Bouckaert, J. J. Compt. rend. Soc. de biol., 1931, 106: 471.
34. Pal, J. Wien. klin. Wchnschr., 1931, 44: 521.
35. White, J. C. New England J. M., 1931, 205: 449.

1932

36. Danielopolu, D., and Aslan, A. Ztschr. f. klin. Med., 1932, 120: 237.
37. Durante, L. Wien. med. Wchnschr., 1932, 82: 1075.
38. Hines, E. A., Jr., and Brown, G. E. Proc. Staff Meet. Mayo Clin., 1932, 7: 332.
39. Murphy, F. D., Grill, J., Pessin, B., and Moxon, G. F. Ann. Int. Med., 1932, 6: 31.
40. Pieri, G. Riforma med., 1932, 48: 1173.
41. Raab, W. Wien. klin. Wchnschr., 1932, 45: 1101, 1130.
42. Rogers, E. Am. Heart J., 1932, 8: 269.
43. Santucci, G. Clinique, Par., 1932, 27: 9.

1933

44. Craig, W. M., and Brown, G. E. Proc. Staff Meet. Mayo Clin., 1933, 8: 373.
45. DeGroat, A., Davis, H. H., and McDonald, C. H. Proc. Soc. Exper. Biol. & Med., 1933, 30: 1296.
46. Hines, E. A., Jr. J. South Carolina M. Ass., 1933, 29: 186.

1934

47. Abelson, L. Med. Rec., New York, 1934, 140: 604.
48. Adson, A. W., and Brown, G. E. J. Am. M. Ass., 1934, 102: 1115.
49. Ayman, A. J. Am. M. Ass., 1934, 102: 1869.
50. Bacz, Z. M., Brouha, L., and Heymans, C. Arch. internat. de pharmacod. et de thérap., 1934, 48: 429.
51. Bauer, J., and Leriche, R. Presse méd., Par., 1934, 42: 1385.
52. Brown, G. E. Med. Clin. North Am., 1934, 18: 577.
53. Craig, W. M. West. J. Surg., Obst. & Gynec., 1934, 42: 146.
54. Craig, W. M., and Brown, G. E. Arch. Int. Med., 1934, 54: 577.
55. Cushing, H. Am. J. Path., 1934, 10: 145.
56. DeCourcy, C. Ann. Surg., 1934, 100: 310.
57. DeCourcy, J. L., DeCourcy, C., and Thuss, O. J. Am. M. Ass., 1934, 102: 1118.
58. Goldblatt, H., Lynch, J., Hanzal, R. F., and Summerville, W. W. J. Exper. M., 1934, 59: 347.
59. Hutton, J. H. Illinois M. J., 1934, 66: 120.

60. LANGERON, L., VINCENT, G., and DESORCHER. Presse méd., Par., 1934, 42: 1033.
61. LEITER, L., and GRINKER, R. R. Arch. Neurol. & Psychiat., 1934, 31: 54.
62. LERICHE, R. Lyon chir., 1934, 31: 355.
63. MEILLÈRE, J., and OLLIVIER, H. R. J. de chir., 1934, 44: 342.
64. MONIER-VINARD and DESMAREST. Bull. et mém. Soc. méd. d. hop. de Par., 1934, 50: 1116, 1118.
65. OLLIVIER, H. R., and MEILLÈRE, J. Presse méd., Par., 1934, 42: 729.
66. PAGE, I. H. J. Clin. Invest., 1934, 13: 909.
67. SUERMONDT, W. F. Zentralbl. f. Chir., 1934, 61: 70.

1935

68. BROWN, G. E. Med. Clin. North Am., 1935, 19: 517.
69. BROWN, G. E., CRAIG, W. M., and ADSON, A. W. Minnesota Med., 1935, 18: 134.
70. DECOURCY, J. L. J. Med., Cincinnati, 1935, 16: 244.
71. Idem. Am. J. Surg., 1935, 30: 404.
72. GREEN, M. F., and DEGROAT, A. Am. J. Physiol., 1935, 112: 488.
73. GREEN, M. F., DEGROAT, A. F., and MCDONALD, C. H. Am. J. Physiol., 1935, 110: 513.
74. HEYMANS, C., and BOUCKAERT, J. J. Compt. rend. Soc. de biol., 1935, 120: 82.
75. KOENIGSBERGER, C. Minnesota Med., 1935, 18: 242.
76. LERICHE, R., HERMANN, H., and MARTIN, P. E. Presse méd., Par., 1935, 43: 449.
77. LERICHE, R., and RAVAULT, P. P. Lyon méd., 1935, 156: 258.
78. LIVINGSTONE, J. L. Lancet, 1935, 2: 961.
79. PAGE, I. H. Am. J. Physiol., 1935, 112: 166.
80. PAGE, I. H., and HEUER, G. J. J. Clin. Invest., 1935, 14: 22.
81. Ibid., p. 27.
82. PEET, M. M. Proc. Calif. Acad. Med., 1935–1936.
83. SPARK, C. Arch. Path., 1935, 19: 473.

1936

84. ADSON, A. W., CRAIG, W. M., and BROWN, G. E. Surg., Gynec. & Obst., 1936, 62: 314.
85. BISGARD, J. D., and SHARPE, J. C. Nebraska State M. J., 1936, 21: 131.
86. CADY, J. B., HORTON, B. T., and ADSON, A. W. Proc. Staff Meet. Mayo Clin., 1936, 11: 825.
87. CHABANIER, H., LOBO-ONELL, C., and GAUME. Presse méd., Par., 1936, 44: 307.
88. COLLINS, D. A. Am. J. Physiol., 1936, 116: 616.
89. CRILE, G. J. Michigan State M. Soc., 1936, 35: 694.
90. Idem. Illinois M. J., 1936, 70: 115.
91. Idem. Cleveland Clin. Quart., 1936, 3: 201.
92. FINDLAY. California & West. Med., 1936, 45: 334.
93. FRALICK, F. B., and PEET, M. M. Arch. Ophth., 1936, 15: 840.
94. GOLDBLATT, H., GROSS, J., and HANZAL, R. F. Am. J. Path., 1936, 12: 760.
95. HEUER, G. J. Ann. Surg., 1936, 104: 771.
96. HINES, E. A., JR., and BROWN, G. E. Am. Heart J., 1936, 11: 1.
97. LERICHE, R. Rev. de chir., Par., 1936, 55: 635.
98. LERICHE, R., FONTAINE, R., FROEHLICH, F. Compt. rend. Soc. de biol., 1936, 121: 991.
99. PICKERING, G. W. Clin. Sc., 1936, 2: 185.
100. PICKERING, G. W., and KISSIN, M. Clin. Sc., 1936, 2: 201.
101. PICKERING, G. W., KISSIN, M., and ROTHSCHILD, P. Clin. Sc., 1936, 2: 193.
102. PRINZMETAL, M., and WILSON, C. J. Clin. Invest., 1936, 15: 63.
103. WETHERALL, F. S. New York State J. M., 1936, 36: 1284.
104. WHITE, S. M. Surg., Gynec. & Obst., 1936, 62: 332.

1937

105. ADSON, A. W., and ALLEN, E. V. Proc. Staff Meet. Mayo Clin., 1937, 12: 1.
106. Ibid., p. 49.
107. Ibid., p. 75.
108. ALLEN, E. V., and ADSON, A. W. Proc. Staff Meet. Mayo Clin., 1937, 12: 727.
109. Idem. Am. Heart J., 1937, 14: 415.
110. Idem. Proc. Staff Meet. Mayo Clin., 1937, 12: 588.
111. ALPERT, L., ALVING, A. S., and GRIMSON, K. S. Proc. Soc. Exper. Biol. & Med., 1937, 37: 1.
112. BARKER, M. H. Wisconsin M. J., 1937, 36: 28.
113. BAUMGARTNER, A., and HARVIER, P. Paris méd., 1937, 103: 395.
114. BISGARD, J. D. Nebraska State M. J., 1937, 22: 174.
115. BLALOCK, A., and LEVY, S. E. Ann. Surg., 1937, 106: 826.
116. CICERI, C. Presse méd., Par., 1937, 45: 1245.
117. CRAIG, W. M. Ohio State M. J., 1937, 33: 1003.
118. CRILE, G. Pennsylvania M. J., 1937, 40: 1017.
119. DRAGSTEDT, L. R., PROHASKA, J. V., and HARMS, H. D. Am. J. Physiol., 1937, 119: 298.
120. FREEMAN, N. E., and PAGE, I. H. Am. Heart J., 1937, 14: 405.
121. FREYBERG, R. H., and PEET, M. M. J. Clin. Invest., 1937, 16: 49.
122. FRIEDMAN, L., and EISENBERG, A. A. New York State J. M., 1937, 37: 1131.
123. GOLDBLATT, H. J. Exper. M., 1937, 65: 671.
124. Idem. Ann. Int. Med., 1937, 11: 69.
125. GOLDBLATT, H., GROSS, J., and HANZAL, R. F. J. Exper. M., 1937, 65: 233.
126. GOLDBLATT, H., and WARTMANN, W. B. J. Exper. M., 1937, 66: 527.
127. GRIMSON, K. S., WILSON, H., and PHEMISTER, D. B. Ann. Surg., 1937, 106: 801.
128. HERMANN, H., and JOURDAN, F. Compt. rend. Soc. de biol., 1937, 126: 1016.
129. HERMANN, H., and SABADINI, L. Presse méd., Par., 1937, 45: 41.
130. HEUER, G. J. Bull. N. Y. Acad. Med., 1937, 13: 692.
131. HOLLINSHED, W. H., and FINKELSTEIN, H. J. J. Comp. Neurol., 1937, 67: 215.
132. LEARY, D. C., and ZIMMERMAN, H. M. Am. J. Path., 1937, 13: 213.
133. LOWENSTEIN, W., and WEISSMANN, A. Wien. med. Wchnschr., 1937, 87: 675.
134. PAGE, I. H. Bull. N. Y. Acad. Med., 1937, 13: 645.
135. PAGE, I. H., and HEUER, G. J. Am. J. M. Sc., 1937, 193: 820.
136. Idem. Arch. Int. Med., 1937, 59: 245.
137. PAGE, I. H., and SWEET, J. E. Am. J. Physiol., 1937, 120: 238.
138. PROHASKA, J. V., HARMS, H. D., and DRAGSTEDT, L. R. Ann. Surg., 1937, 106: 857.
139. SHIPLEY, A. M., and AYCOCK, T. B. South. M. J., 1937, 30: 160.
140. SMITHWICK, R. H. New England J. M., 1937, 216: 141.
141. WALTER and PIJOAN. Surgery, 1937, 1: 282.
142. WILSON, R. Internat. Clin., 1937, 1: 191.

1938

143. ALLEN, E. V., and ADSON, A. W. Proc. Staff Meet. Mayo Clin., 1938, 13: 426.

144. Barker, N. W., and Walters, W. Proc. Staff Meet., Mayo Clinic., 1938, 13: 118.
145. Binger, M. W., and Craig, W. M. Proc. Staff Meet., Mayo Clin., 1938, 13: 17.
146. Boyd, C. H., and Lewis, L. G. J. Urol., 1938, 39: 627.
147. Cannon, W. B. J. Am. M. Association, 1938, 111: 556.
148. Craig, W. M. South. Surgeon, 1938, 7: 97.
149. Crile, G. Cleveland Clin. Quart., 1938, 5: 33.
150. Idem. Ann. Surg., 1938, 107: 909.
151. Idem. The Surgical Treatment of Hypertension. Philadelphia and London: W. B. Saunders Company, 1938.
152. Culpepper, W. L., Madden, E. E., Olson, E. C., and Hutton, J. H. Endocrinology, 1938, 22: 236.
153. Davis, L., and Barker, M. H. Ann. Surg., 1938, 107: 899.
154. Fabre, R., and Jeanneney, G. J. méd. franç., 1938, 27: 55.
155. Glenn, F., and Child, C. G. Arch. Surg., 1938, 36: 375.
156. Glenn, F., Child, C. G., and Heuer, G. J. Ann. Surg., 1938, 107: 618.
157. Glenn, F., Child, C. G., and Page, I. H. Am. J. Physiol., 1938, 122: 506.
158. Glenn, F., and Lasher, E. P. Proc. Soc. Exper. Biol. & Med., 1938, 38: 158.
159. Goldblatt, H. J. Exper. M., 1938, 67: 809.
160. Gunewardene, H. O. J. Ceylon Br. Brit. M. Ass., 1938, 35: 9.
161. Hermann, H., Jourdan, F., Moriu, G., Vial, J., and Cornut, P. Lyon méd., 1938, 161: 160.
162. Horton, B. T., and Brumm, H. J. Minnesota Med., 1938, 21: 119.
163. Ivy, A. C. Internat. Abstr. Surg., 1938, 66: 1.
164. Karsner, H. T. New Internat. Clin., 1938, 2: 1.
165. Leadbetter, W. F., and Burkland, C. F. J. Urol., 1938, 39: 611.
166. Leathem, J. H. Proc. Soc. Exper. Biol. & Med., 1938, 38: 546.
167. Leiter, L. J. Am. M. Ass., 1938, 111: 507.
168. Leriche, R. Presse méd., Par., 1938, 46: 489.
169. Leriche, R., Wertheimer, P., and Martin, P. E. Lyon méd., 1938, 161: 15.
170. McCann, W. S. Arch. Int. Med., 1938, 61: 501.
171. Page, I. H. J. Am. M. Ass., 1938, 110: 1161.
172. Idem. Am. J. Physiol., 1938, 122: 352.
173. Peet, M. M. Presented at Louis Greenfelder Mem. Lecture, Chicago, Nov. 1937. In press, 1938.
174. Idem. Personal communication, 1938.
175. Reid, D. E., and Teel, H. M. Am. J. Obst. & Gynec., 1938, 35: 305.
176. Rogoff, J. M., and Marcus, E. J. Am. M. Ass., 1938, 110: 2127.
177. Rogoff, J. M., Marcus, E., and Wassermann, P. Proc. Soc. Exper. Biol. & Med., 1938, 38: 199.
178. Rogoff, J. M., Nixon, E. N., Stewart, G. N., and Marcus, E. Proc. Soc. Exper. Biol. & Med., 1938, 37: 715.
179. Tanturi, C. A., and Ivy, A. C. Am. J. Physiol., 1938, 121: 61.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Fischer, E.: Symptoms of Pressure upon the Corpus Callosum Demonstrated by Arteriography (Das Symptom der Balkenpressung im Gefaessbild). *62 Tag. d. deutsch. Ges. f. Chir.*, Berlin, 1938.

Blood-vessel photography today has a definite place in the diagnosis of brain tumors. Except in cases of blood-vessel degeneration, arteriography is employed in place of ventriculography in all growths of the anterior, parietal, temporal lobes of the brain, and in growths in the region of the sella. Demonstration of the blood vessels is not only more definite but it is less harmful, and better diagnoses are obtained not only in relation to the site but also as to the nature of the growth. The method employed is that of Loehr, Olivecrona, and Toennis; pictures are made in two planes, and in contrast to Monitz considerable importance is given to the anterior view. And in contrast to Monitz and Loehr the injection is done on one side only, that of the tumor. This procedure in most cases is sufficient to demonstrate the lesion and is easier on the patient with marked cerebral edema. From the author's large number of vessel pictures he presents only a few characteristic cases and calls attention to the anterior view and the relation of the anterior cerebral artery to the different tumors. The misplacement of the anterior cerebral artery by tumors in the immediate vicinity should be differentiated from that due to pressure exerted more distantly. The anterior view has been divided into distinct areas and on this basis 5 types of local disturbance of this artery are described: (1) the beginning of the horizontal section, by small parasellar tumors; (2) the lower rising portion, by basal tumors; (3) the middle upper rising portion, by frontal lobe processes; (4) the anterior epicallosal portion, by paramedian and frontal tumors, and (5) the posterior epicallosal portion, by paramedian tumors in the parietal region. A characteristic finding in this anterior view is the extension of the tumor with a local stretching out of the vessels over the median line to the healthy side.

The displacements of the artery in the anterior view are entirely different if the lesion is a distant one, especially if the seat of the tumor is in the parietal or temporal lobes. The portion of the anterior cerebral artery in the knee of the corpus callosum and the anterior portions of the pericallosal and callosomarginal arteries, with the more movable anterior portions of the corpus callosum and the neighboring cerebral convolutions under the free edge of the falx, are pressed to the sound side. These are cases in which also the ventricle shape as a result of the callosal pressure may give the "paradoxical impression" described by Winkelbauer. Characteristic for the action of distant tumor pressure in the anterior arteriographic picture are: (1) a wavy, frequently tuft-like course of the anterior rising portion of the anterior cerebral artery, and (2) a typical displacement of the anterior callosal portion of the anterior cerebral artery.

In the discussion MACKH stated that hemisphere tumors, which arise in the domain of the internal carotid artery, are always demonstrable with arteriography. Tumors which cannot be demonstrated are those of the posterior fossa and those which are medianly placed and supplied by the circ. arteriosus. Bilateral arteriography is not always necessary. The lateral and frontal views are of more importance. Mackh demonstrated several cases very clearly with arteriograms, which were not at all clear in the clinical picture. In conclusion, he presented the arteriogram of a patient who for a number of years was treated as a genuine epileptic and who according to the authorities ought to have been sterilized. In the arteriogram, however, the findings were those of a temporal-lobe tumor on the right side. The patient was cured by a radical operation.

The value of arteriography during the last few years has become so apparent that today it is considered a mistake to operate for a cerebral tumor without arteriography beforehand. Within the near future, arteriography will offer more in the diagnosis of cerebral tumors than all the other methods usually employed.

LEO A. JUHNKE, M.D.

Roettgen, P., Selbach, H., Stockert, F. G. von, and Toennis, W.: Studies and Observations on the Development of Transitory Postoperative Focal Symptoms and Changes in the Cerebrospinal Fluid (Untersuchungen und Beobachtungen ueber die Entstehung voruebergehender postoperativer Herdsymptome und postoperativer Liquorveraenderungen). *Zentralbl. Neurochir.*, 1938, 3: 12.

Transitory focal symptoms after brain operations. Roettgen and Stockert reported aphasic disturbances which occurred suddenly on the third or fourth day after operation regardless of the site of the tumor or the parts of the brain involved. In right-handed individuals the symptoms arose in tumors of the left side, never in tumors on the right side. These were always motor aphasic disturbances in the sense of a Gerstmann syndrome (finger agnosia, with right-left disturbance, difficulty in arithmetic, and agraphia of the parietal type). In spite of severe aphasia and apraxia, there was no noteworthy paresis. There was never a sensory aphasia; only direct trauma was involved. These authors also reported psychic disturbances after operations in the hypothalamus region. Foerster and Gagel have pointed out that with stimulation of the anterior portion of the third ventricle some syndromes of trauma to the posterior portion appear belatedly. Amnesia may occur also, but it disappears after from two to five days. There-

fore, this is a typical midbrain syndrome. These phenomena are similar to the first temporary local inflammatory postoperative focal reactions. More extensive symptoms are induced by cerebral edema. The authors also often observed on the third or fourth day an organic disturbance of consciousness with psychomotor inhibitions and definite perseveration. However, all of these postoperative disturbances are unpredictable. They do not occur in left-handed individuals nor in children. Why these disturbances occur or do not occur is not known. The type of tumor is not a factor. The explanation lies in the tendency toward edema, which is characteristic of brain tissue. Hypertonia may be a contributory factor, as well as the state of nutrition (too much sodium chloride). At present, preparation and after-care are not the most important factors in the success of brain surgery. The operative technique is today so perfected that tumors of benign histological structure are no longer considered inoperable. Correct diagnosis is now possible in almost 100 per cent of the cases.

Psychic disturbances after brain operations. Stockert asks whether a brain operation is to be compared with brain trauma resulting from blunt injuries to the skull. This view may be substantiated by the development on the third day after operations in the vicinity of the hypothalamic centers, of typical "midbrain" symptoms, such as sleep in the daytime, and restlessness at night, delirium with disorientation as to time and place, and disturbances of memory for the immediate past as in a Korsakoff syndrome. The cerebral commotion is characterized by unconsciousness and retrograde amnesia. As we know, such is not the difficulty in cases operated upon under local anesthesia; neither does retrograde amnesia occur after brain operations. Exceptions occur when operation is done in the abdominal position, or for the purpose of freeing the chiasma region and some spinal fluid is withdrawn so that the brain sinks markedly forward or backward and the patient becomes sleepy and helpless. These symptoms disappear as soon as the position of the brain is changed or when the spinal fluid is replaced by saline solution.

Upon stimulation of the intercerebral midbrain regions, the patients present a retrograde amnesia up to the third or fourth day after operation and from the moment that they begin to feel sleepy. Psychotic postoperative disturbances may also be induced by increased intracranial pressure, arachnoiditis, and cerebral edema, as typical postoperative biological changes. Most of the patients developed on the second or third day of this illness an organic disturbance of consciousness in the sense of a psychomotor inhibition and in finding words for expression. In a series of 400 patients with brain tumors which were studied histologically, there were 7 cases of temporary hallucination. Among these were 5 cases of cerebellar tumor in which occlusive hydrocephalus had existed for some time.

Postoperative cerebrospinal fluid changes. Selbach carried out studies on the cerebrospinal fluid of 460 patients who had undergone trepanation; 309 of these patients had brain tumors. At no time was there observed any regular correlation of the alkali reserve or albumin concentration in the fluid from various locations (ventricles, cisterns, or lumbar regions). In brain tumors, whether supratentorial or infratentorial, no noteworthy diagnostic conclusions could be reached by examinations of the cerebrospinal fluid prior to operation. Postoperative examinations of the fluid in these patients indicated that in the first five or ten days there was a correlation between the high albumin and the low alkali reserve values, which values equalized themselves in that period of time. These values were related more to the metabolic changes in the field of operation than to the general metabolism. Analogous changes in the alkali reserve and albumin concentration of the blood have been reported by Toennis in resection of the knee joint. There was an increase in the acid radicles as a result of the physicochemical changes induced by the operation, particularly in the cerebral tissues. A spinal fluid is evolved which is not isotonic; there is an increased amount of cerebrospinal fluid and an increase in the volume of the brain. (Franz). Jacob E. Klein, M.D.

Evans, H. S., and Courville, C. B.: Calcification and Ossification in Tuberculoma of the Brain: Review of the Literature and Report of 3 Cases. *Arch. Surg.*, 1938, 36: 637.

In this article the authors describe 3 cases of calcification and ossification in tuberculoma of the brain. Reports on this subject are extremely rare and it is apparent that calcification in a tuberculoma occurs very infrequently, in only about 7 per cent of the tuberculomas of the brain. All 3 cases occurred in young Mexican children; in 2 of them the early signs were those of tuberculous meningitis, and in the third they were signs of a progressive hemiplegia simulating tumor. In every case a very careful necropsy was performed and the specimens from the brain were given an especially careful histological examination. The authors discussed ideas on the deposit of calcium in tuberculomas and on the process of calcification. They pointed out that the formation of bone in tuberculomas occurs, but that it is much less frequent than the laying down of calcium.

The bibliography is comprehensive. Altogether 15 cases of this deposition of calcium in tuberculomas have been reported, to which the authors have added the very instructive study of their 3 cases.

Adrien Verbrugghen, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Funck-Brentano, P., Bertrand, I., and Poilleux, F.: Phyllode Tumors of the Breast (Les tumeurs phyllodes du sein). *J. de chir.*, 1938, 51: 506.

The "phyllode" tumors of the breast were described by Johann Mueller in 1828 as definitely benign cystosarcoma phyllodes. In 1931, Lee and Pack collected 111 cases of this type. Funck-Brentano and his associates at the Salpêtrière report that in the surgical clinic of this Hospital 5 cases of this type were observed from 1919 to 1936. In this same period there were 502 malignant epithelial tumors of the breast, 6 sarcomas, and 198 benign adenomas treated at this clinic.

The tumors may grow to a large size, but usually the patient comes to the surgeon when the growth is about the size of a fist. On section, the tumor is found to be lobulated; the general arrangement of the lobules and cystic cavities suggests a leaf, hence the name "phyllode." The cystic formations are not true cysts, as a rule, but areas of myxomatous degeneration or necrosis; parts of the tumor are solid. The tumor does not infiltrate the underlying muscle or aponeurosis; neither does it invade the skin. The axillary glands, which have been carefully examined in a number of cases, show no pathological changes. Histologically the tumor shows groups of epithelial cells representing glandular tissue in dense connective tissue.

More characteristic are the fissures lined with epithelium which divide the tumor into lobules. The phyllode tumor resembles an intracanalicular adenofibroma in many respects, but its lobules are much larger and in more regular arrangement. The stroma is characteristic in these tumors and is more abundant than in the adenofibroma; it shows in some areas a proliferation of fibroblasts, but with no neoplastic mitosis or other signs of malignancy. In other areas a sarcomatous appearance is noted; in these areas the lobules show degeneration, the characteristic phyllode appearance is lost, and neoplastic fibroblasts with large nuclei showing mitosis are present. Such sarcomatous degeneration is found only in certain limited areas, and does not seem to have the power of extending indefinitely. This is an unusual finding in tumor pathology, and such areas of sarcomatous changes are found in tumors of this type which are operated upon in an early as well as in a later stage of their development. In other areas the stroma shows a myxoid appearance; the cells have many ramifications, they anastomose with each other, and have a clear substance in the interstices. In still other areas the stroma may show an edematous infiltration. It is this myxoid and edematous stroma that gives to some lobules a cystic appearance. The epithelial elements of the tumor show less polymorphism than the stroma, and never any indication of neoplastic change. Certain areas of the tumor undergo necrotic changes, which are often accompanied by edematous infiltration of the stroma. The authors propose the designation "fibroadenomyxoma phyllodes" for this tumor as it indicates its anatomical, chemical, and histological characteristics.

Clinically, these tumors develop very slowly and do not attract the patient's attention until they reach a considerable size. On examination, the tumor is irregular in form and nodular underneath the skin. The skin over it may appear entirely normal, or may appear as if stretched, and sometimes reddened, with the venous network more prominent than normal. In certain portions the tumor is soft, in others hard; on the whole it is more elastic and less indurated than a cancer. It is freely movable, because it is not adherent to either the muscular tissue at its base, or the skin above it. Unless the tumor has grown to a large size, the general condition of the patient is good. If operation is performed, even at an advanced stage, complete cure is usually obtained. There are neither glandular nor distant metastases. Occasionally there may be a local recurrence, but such recurrences are benign and operable. If the tumor is small, the preoperative diagnosis is usually adenofibroma; this diagnosis can be corrected by examination of sections of the tumor. If the tumor is large, a diagnosis of sarcoma is more apt to be made.

Treatment is operative, and it is desirable to examine gross sections of the tumor at the time of operation. If the tumor is small and the patient is a young woman, conservative operation (subcutaneous removal of the tumor) may be done. Even if the operation is followed by recurrence, the recurrence is also benign, and a more extensive operation may be done for removal of the breast. However, in the majority of cases the conservative operation is sufficient. With a large tumor, amputation of the breast is necessary, but a radical operation with removal of the axillary glands is not indicated.

ALICE M. MEYERS.

Cohn, I.: Carcinoma of the Breast in the Negro. *Ann. Surg.*, 1938, 107: 716.

This article is based on a study of negro patients who were admitted to the Charity Hospital, New Orleans, for treatment of carcinoma of the breast. The study was made with a view to determining the relative frequency of breast cancer in the white and negro races, the stage of its development at the time of admission to the hospital, the methods of treatment employed, and the results obtained.

In the period from 1932 to 1936 inclusive, 481 patients with carcinoma of the breast were admitted to the Charity Hospital. Of these, 256 were negroes and 225 were white. The percentage of colored

patients with breast cancer to the total number of patients for the period under study remained constant, i.e., 1.7 per cent. More nulliparous negro women than nulliparous white women presented themselves for treatment of breast cancer. The age of the negro patient averages about four and seven-tenths years younger than that of the white patient. The greatest incidence of breast cancer in the colored person is shown to be in the decade between the ages of forty and fifty years, while its greatest incidence in the white person is between the ages of fifty and sixty years. Sixty per cent of the patients had metastases in the axillary lymph nodes when they were admitted to the hospital, and of 224 patients whose records were adequate for use in this study, only 118 were considered suitable for radical operation. In 27 of the patients, operation could not be considered. These facts are an indication of the late stage of the condition in which this group of patients presented themselves for treatment.

The percentage of known deaths following radical operation is given as 46. If to this is added the cases of patients who could not be followed up, the deaths occurring within from one to five years after operation may be well above 65 per cent. Only 74 per cent of the colored patients received any form of preoperative roentgenological investigation. Therefore the percentage of skeletal metastases in this series cannot be accurately estimated.

JACOB M. MORA, M.D.

Taylor, G. W., and Meltzer, A.: Inflammatory Carcinoma of the Breast. *Am. J. Cancer*, 1938, 33: 33.

The authors present a clinical study of 38 cases of inflammatory carcinoma of the breast seen over a period of nine and one-half years.

This grave disease is not rare; the literature contains more than 100 cases. The incidence was 4 per cent of all breast cancers in our series. Although the disease is rare after seventy, its age distribution is the same as for cancer of the breast in general.

The inflammation may be of a primary type, i.e., it may arise simultaneously with the cancer, or it may be of the secondary type, i.e., it may occur after a scirrhous cancer has been present for some time. Pain is a common early symptom in the primary type. The inflammatory signs may result in mistakes in the diagnosis and injudicious early therapy.

The primary type comes to medical attention early, yet the inflammatory signs are usually full-blown and the disease is widespread on admission. The cancer may have an acute erysipeloid distribution or show a tendency toward nodular localization. Ulceration is rare.

The disease spreads rapidly in the superficial lymphatic structures of the chest wall. Multiple visceral metastases occur early, but the rapid course of the disease often does not permit them to attain clinical recognition. Bone metastases were recognized roentgenologically in only 4 primary cases. In the uncomplicated cases leucocytosis, fever, and other signs of toxicity are rare. The patients maintain remarkably good health throughout the greater part of the course of the disease and cachexia is unusual. Death is due most often to intrathoracic complications. The average duration of life in primary cases was twenty-one and three-tenths months and in secondary cases ten and eight-tenths months after appearance of the inflammatory signs.

The inflammatory signs of edema, redness, and heat are due to extensive lymphatic blockage by the cancer and congestion of the subpapillary plexus. There is no uniform pathological type.

The large fatty breast, as well as the hyperplastic breast of late pregnancy or lactation, seem to be predisposing factors of inflammatory carcinoma. No other predisposing factors could be established.

The results of therapy are poor. Surgery is followed by prompt evidence of supraclavicular disease, skin recurrence, or invasion of the opposite breast. X-ray treatment seems to give the best palliative results. The artificial menopause does not alter the course of the disease. JOSEPH K. NARAT, M.D.

Bérard, L., and Ponthus, P.: The Place of Radiotherapy in the Treatment of Cancer of the Breast (La position actuelle de la radiothérapie dans le traitement du cancer du sein). *Lyon chir.*, 1938, 35: 129.

Bérard and Ponthus note that it is difficult to evaluate the efficacy of various methods of treatment in cancer of the breast. Breast cancers are of different histological types and vary in their clinical development. Statistics of the results of surgical and radiological treatment include all these types and do not, as a rule, clearly differentiate them. The evolution of these tumors is prolonged; while five years freedom from recurrence is generally considered to be a criterion of cure, this period is really too short, as recurrences may develop in the lymphatic region of the primary tumor after a much longer period of time.

In considering the clinical use of radiotherapy, the authors note that a number of surgeons advocate pre-operative radiotherapy for large tumors with numerous adhesions, or for "sterilization" of the neighboring lymphatics and to prevent the dissemination of cancer cells. At the Center for the Prevention and Treatment of Cancer at Lyon, 13 patients with inoperable cancer of the breast were treated by radiation; in all of them the tumor was rendered operable. Two of these patients were living in 1936, seven and nine years, respectively, after operation; the others had died an average of two years after treatment. The dosage used was from 1,500 to 1,800 roentgens per field, with a copper filter from 0.5 to 1 mm. in thickness, and a current of 200 kv. The authors believe that pre-operative radiotherapy in such cases of large and adherent tumors is of value, but they do not consider pre-operative treatment of tumors that are primarily operable to be necessary, as they agree with Regaud,

that complete "sterilization" of the operative field is not obtained by this method.

In some cases in which it has been impossible to remove the tumor or the regional lymphatics completely, supplementary radiotherapy may be employed; the treatment should be intensive enough to destroy the remaining cancer cells if possible. A dosage of from 3,000 to 4,000 roentgens should be used for each field, with a 1 to 2 mm. copper filter and a 200-kv. current. This dosage may be given in twenty or twenty-five days, except in the cases of glandular epitheliomas or less radiosensitive tumors, in which irradiation should be given in daily treatments or twice-daily treatments for from thirty to thirty-five days.

In cases in which radical operation has been done, Béclère and others advocate prophylactic postoperative radiation. For this purpose divided doses are given over a period of several weeks to make a total of from 1,500 to 2,000 roentgens, and treatment may be repeated with a smaller dosage three and six months later. Regaud, on the other hand, does not approve of such postoperative treatment, claiming that the cells that escape the surgeon's knife are not radiosensitive, and that they are still further "immunized" to radiation by the treatment given. At the Lyon Center, from 1922 to 1928, 141 patients with cancer of the breast were operated upon by the typical Halsted technique without postoperative irradiation; 48 per cent lived more than three years, and from 25 to 30 per cent, more than five years. In 50 cases, the operation was followed by radiation according to Béclère's method of small divided doses. Of this group 39 per cent survived three years and from 15 to 20 per cent, five years. These figures do not appear to be favorable to prophylactic postoperative radiation. Moreover, all of the patients who were given postoperative radiation had cancer in an advanced stage with considerable involvement of the axillary glands, while a number of the patients treated by operation alone had a cancer in the early stage. If these patients are excluded from this group, the percentage of three-year survivals is 41 per cent, or practically the same as that of patients given postoperative radiation. No evidence was found that postoperative radiation favors the occurrence of metastases; the percentage of bone metastases in the two groups, as shown by roentgenological examination, was essentially the same.

Radiotherapy for recurrences is indicated in the following cases:

1. When the recurrence is in the form of multiple cutaneous and subcutaneous nodules in the thorax.

2. When there is involvement of the cutaneous or the parasternal or deep lymphatics. Such recurrences usually advance rapidly and treatment is rarely successful.

3. When the recurrence is in the axillary glands. In these cases treatment is often effective, especially if cross-fire technique is used.

4. When the supraclavicular glands are involved. Radium applied externally with radium molds is often superior to roentgen therapy. The prognosis is poor with any form of treatment.

In some cases of breast cancer, radiation alone is employed. This is usually done in those cases in which the patient refuses operation, or in which operation is contra-indicated on account of the general condition. Regaud has good results with superficial breast cancers in small breasts from radium applied externally. At the Lyon Center, 23 patients with cancer of the breast have been treated with radiation alone. The dosage employed in some of these cases was relatively small, and no conclusions can be drawn from the results obtained in so small a series of cases. As a general rule, the authors believe that operable cancers of the breast should be treated primarily by the surgeon.

ALICE M. MEYERS.

Adair, F. E., Frazell, E. L., and Quimby, E. H.: A Study of Tissue Dosage and Radiation Effect in Cases of Operable Cancer of the Breast Treated by a Combination of Pre-Operative Irradiation and Radical Mastectomy. *Radiology*, 1938, 30: 588.

During the years from 1933 to 1937, pre-operative irradiation has been employed routinely in operable cases of breast cancer at the Memorial Hospital, New York, and data obtained from 201 of these cases are presented to show the correlation between the amount of radiation delivered to the tumor and the radiation effect resulting. Before treatment was initiated, careful measurements had been made relating to the exact size of the tumor, also to its thickness, depth, and position in the breast. One hundred and thirty-eight of the patients were treated with the 200-kv. roentgen rays and 63 were treated with the 4-gm. radium element pack. Variable amounts of irradiation were given at intervals and, after approximately from eight to ten weeks following completion of the pre-operative irradiation, a radical mastectomy was performed. The tissues were then subjected to meticulous pathological study. Differing radiation effects were grouped according to a scale of microscopic changes.

The findings upon which various group effects were based, the technique used, and the means by which dosages were calculated are described in detail. Numerous tables are included to show the relative effects of radium and roentgen rays, the comparison between radiation effects and clinical regression, the relation between the tumor dose and the radiation effect, the relation between the skin dose and the tumor dose, the relation between the size of the tumor and the radiation effect, and the relation between threshold doses and the size of the tumor. All of these topics are discussed at some length.

In both series of cases—those treated by roentgen rays and those treated by the radium pack—the following facts were apparent:

1. The clinical impression as to the residual tumor can be fairly well relied on to express the radiation

effect obtained (in 71 per cent of the cases treated with the x-rays and in 75 per cent of those treated with the radium pack).

2. The larger the minimum tissue dose delivered to the tumor, the more likely is a profound radiation effect to be obtained.

3. It is necessary to deliver with the x-rays at least six threshold skin doses within three weeks, and with radium almost three threshold skin doses within six days, to the deepest portion of the tumor, if the maximum radiation effects are to be obtained in 70 per cent and 56 per cent, respectively.

4. There is a definite relationship between the size of the tumor mass and the radiation effect obtained.

5. The chance of obtaining a high radiation effect decreases as the size of the tumor increases.

6. Since tumors as well as the amounts of overlying tissue vary enormously in size, it is evident that from the same beam of irradiation very different doses may be delivered to the most deep-lying tumor cells. The inadequacy of expressing radiation dosage as a certain number of roentgens, or of milligram hours per port, is evident.

7. The age of the patient and the differences between the intervals following the completion of irradiation and before operation had no apparent influence on the radiation effect observed in the tumor in this series of cases.

ADOLPH HARTUNG, M.D.

TRACHEA, LUNGS, AND PLEURA

Freedman, L. M.: The Etiology of Lung Abscess. *New England J. M.*, 1938, 218: 663.

Although a clinical diagnosis of lung abscess was made in 445 patients at the Boston City Hospital from 1926 to 1935, Freedman selects only 276 (60.2 per cent) of these for this analysis and comparative study.

In this series, 196 cases of lung abscess were attributed to medical conditions; 4 cases followed trauma; and 76 cases occurred as a complication to surgery. Although tonsillectomy was a frequent cause of lung abscess in these patients, it was less frequent than most authors report, and was less frequent than not only pneumonia but also other postoperative conditions. Lung abscess following tonsillectomy is found more frequently in adults (1:626) than in children (1:8852). It is interesting to note that in the 8,768 tonsillectomies performed on adults at the Boston City Hospital during these years, all but 85 of the patients were given a general anesthetic and 14 of them developed lung abscess, whereas there was no abscess in the small group in whom local anesthesia was used.

In general, it was noted that the location of the abscesses, both of medical and postoperative origin, showed a ratio of approximately 2:1 favoring the right lung.

Other statistics of interest in this study are as follows:

The Incidence of Lung Abcess

Condition	Total cases	Lung abscess	Ratio
Medical			
Pneumonia	15,177	104	1:146
Surgical			
Tonsils and Adenoids	26,473	16	1:1654
Teeth	3,204	10	1:320
Appendix	12,702	9	1:1411
Stomach	486	9	1:54
Gall Bladder	2,328	9	1:258
Uterus and Tubes	10,839	14	1:774

HOWARD B. CARROLL, M.D.

Clavelin and Sarroste: Non-Tuberculous Axillary Pleurisy (Les pleurésies purulentes axillaires non tuberculeuses). *Rev. de chir.*, Par., 1938, 57: 85.

Clavelin and Sarroste report 9 cases of non-tuberculous axillary pleurisy. The first case was of the chronic type; the patient had had an attack of pneumonia almost two years before his admission to the hospital. After apparent recovery, he began to cough, frequently showed a febrile temperature, and lost weight. It was supposed that he was tuberculous until x-ray examination showed no tuberculous lesions, but a homogeneous rounded opacity in the left axillary region. Puncture yielded pus, which was sterile. In the 8 other cases the pleurisy was acute; all the patients had acute lobar or bronchial pneumonia; from the eighth to the tenth day of the disease signs of pleural effusion developed, while the pulmonary symptoms began to subside. Roentgenograms and puncture established the diagnosis of axillary pleurisy. In 1 case the effusion was at first serofibrinous, but soon became purulent, though cultures were negative. In 5 cases the effusion was purulent from the first, and hemolytic streptococci were isolated from the pus. In 3 of these cases the lesion was localized in the axillary region at the time of the first x-ray examination. In the 2 other cases, the first roentgenogram showed diffuse pleurisy on the involved side, but gradually this became localized in the axillary region. In the last 2 cases there was an encysted pleurisy with several collections of pus, one being located in the axilla.

It is probable that in all these cases there was at first a diffuse inflammation of the pleura, with ultimate localization of the effusion in the axillary region, but roentgenograms were not made sufficiently early in all of the cases to demonstrate this. When the effusion first became localized in these acute cases, the patient's general condition showed some improvement, and the temperature fell, but not to normal; after a few days the temperature rose again and the signs and symptoms of pleural involvement became more marked. The localization of the pleural effusion in the axilla is probably to be attributed to the fact that the pulmonary lesion was more extensive in this region than elsewhere, and after a phase of diffuse inflammation of the pleura, the effusion tended to localize around it.

During the phase of diffuse inflammation, the treatment is medical, with the aim of aiding the

resorption of the pleural edema. During the process of the localization of the effusion, puncture is indicated for drainage and for the injection of antiseptics; the authors have employed collargol or electrargol. In some cases in which the collection of pus is difficult to reach, puncture should be done under fluoroscopic control by the surgeon. Injections of collargol especially have given favorable results in the authors' experience; they have prevented secondary infection, relieved symptoms, and hastened the evolution of the abscess. The authors have found, however, that acute purulent axillary pleurisy due to streptococci cannot be cured by this procedure alone. Surgical drainage by means of rib resection and pleurotomy is necessary. The site of operation should be planned so that the lowest point of the abscess is drained without opening of the large pleural cavity. The best site for the operation is usually the median axillary line, the level varying with the location and extent of the lesion, as shown by roentgenograms and puncture. In 2 of the authors' cases reported, the fourth rib was resected; in 1 case, the seventh rib; in 4 cases, the eighth rib; and in 2 cases, the ninth rib. This operation should be done when the axillary abscess has fully "matured," but before a thick capsule has formed; the optimum time is the fourth week after the onset of the acute pulmonary disease. If fever recurs after a few days of normal temperature, or if the amount of pus increases constantly in spite of puncture and drainage, operation is indicated. This operation gives good results in acute cases; the wound heals well; and if postoperative breathing exercises are carried out regularly with the spirometer, the lung expands normally. In chronic cases, however, as in the first case reported, a second operation is necessary after rib resection and pleurotomy, to completely obliterate the cavity and ensure normal expansion of the lung. This consists in a thoracectomy with rib resection beyond the limits of the original lesion, but the resection of the pleura should not exceed these limits; decortication of the lung is usually necessary. The results of operation in chronic cases are not as favorable as those in acute cases; a considerable degree of invalidism is the sequel. ALICE M. MEYERS.

Carter, B. N.: The Use of Muscle Flaps in the Closure of Chronic Empyema Cavities. *Surgery*, 1938, 3: 506.

In view of the fact that the literature to date bears comparatively few references to the use of muscle flaps in the closure of chronic empyema cavities, the article presented by Carter assumes great significance. The two main objectives of it are: first, to emphasize the fact that adequate drainage by the resection of long segments of several ribs and wide exteriorization of the empyema cavity is the most important step in the treatment of chronic empyema; and second, to call attention to the advantage of pedicled muscle flaps in the closure of the chronic empyema cavity that remains after adequate drainage has accomplished all it can. The many illustrations which accompany the article show the steps in the various operative procedures and serve admirably to explain the text as well as to illustrate several useful technical points concerning various muscles which can be used as "fills."

At the outset the author stresses the fact that many chronic empyema cavities will obliterate themselves completely or in part if really adequate drainage is provided. This is true particularly in cases of chronic empyema which are of relatively short duration. Some types of chronic empyema, however, do not yield such satisfactory results, even with ideal drainage conditions. In this category three types of chronic empyema are outstanding, namely, (1) secondarily infected tuberculous empyema, (2) nontuberculous empyema of several years' standing, and (3) chronic empyema complicated by bronchial fistulas. The first of these groups presents a particularly difficult problem, not only on account of the extensive fibrosis of the lung and pleura which prevents lung expansion, but also on account of the possibility of its lighting up the quiescent tuberculosis by expanding the lung. What nature, then, cannot accomplish by way of lung expansion the surgeon must try to supplement in the task of obliteration of the cavity. This he does by means of plastic operations on the thoracic wall. In cases of long-standing non-tuberculous empyema, greatly thickened visceral and parietal pleura and fibrosed lung tissue also prevent adequate expansion of the lung. Bronchial fistulas are serious complications since they interfere with lung expansion, reinfect the wound, and preclude active irrigation of the cavity.

It becomes quite evident, then, that many cases of chronic empyema will reach a stage during their treatment when a cavity which cannot, without further surgical treatment, decrease in size is still present. It is with these stubborn cases of empyema cavities that the author's article deals. Two underlying principles are all-important in the surgical treatment of these cases, namely, adequate drainage and wide exteriorization of the empyema cavity. The resection of short segments of one or two ribs and the introduction of a large rubber tube do not constitute adequate drainage. To accomplish his objective the author recommends that the chest wall be widely opened by the resection of at least 4 in., preferably 6 in., of two or three ribs situated at the lowermost portion of the empyema cavity. The thickened parietal pleura thus exposed is excised to the limits of the incision laterally and to the remaining ribs above and below. An opening from 4 to 6 in. long and from 3 to 4 in. wide is thus made into the dependent portion of the cavity. Through such an opening the interior of the cavity can be inspected, foreign bodies, if present, can be removed, bronchial fistulas discovered, and pockets found. Thereupon thorough irrigation with Dakin's solution or azochloramide can be carried out. Also light packs saturated with these solutions can be placed in contact with the walls of the entire cavity. No drainage

tubes are needed since by sewing of the skin edges to the edges of the pleura the cavity is exteriorized and the opening into it cannot close.

After this process of exteriorizing the cavity there should follow treatment with Dakin's solution or azochloramide. This is to continue until the cavity has been obliterated by the gradual expansion of the lung or until it has ceased to decrease in size. If complete expansion occurs, the skin edges can be readily freed and closed. If, however, a residual cavity remains, a more extensive plastic operation becomes necessary.

The further surgical procedure to obliterate the residual cavity is dependent upon the type, the size, and the location of the cavity. A chronic empyema cavity with relatively thin parietal pleura can be closed or greatly decreased in size by extrapleural thoracoplasty done in many stages and with formalinization of the rib beds. If, however, the parietal pleura is very thick, a simple thoracoplasty will not accomplish much in decreasing the size of the cavity. Even though the ribs be resected from spine to sternum, the rigid pleura continues to hold the cavity open. The small cavity in the lower thorax can be obliterated simply by the resection of the ribs and the thick pleura overlying it, while the soft tissues are allowed to fall into and fill the cavity. However, the large cavities in the lower portion of the thorax, those cavities lying beneath the scapula, and also those at the apex of the thoracic cage, cannot be so easily closed. The scapula will not fall completely in contact with the underlying lung after the ribs beneath it have been resected, and, unless a "fill" of some sort is placed beneath the scapula, a dead space will persist which may give rise to a recurrence of the empyema. Likewise, the configuration of the thorax at the apex is such that cavities situated there will not be filled by the falling in of the soft tissues when the ribs overlying the cavity have been removed. It is in these instances that muscle flaps can be swung into the empyema cavity in order to obliterate it. The following muscles are available for this purpose: the latissimus dorsi, the trapezius, the sacrospinalis, and the pectorals. Before the muscle flap is swung into a cavity situated in the lower thorax, the ribs should have been removed beyond the limits of the cavity and the parietal pleura excised to the margins of the cavity. In the case of some of the cavities that extend to the apex or under the scapula, not all the ribs over the cavity need be removed; it is sufficient to fill the resulting recess beneath one or two ribs with the muscle flaps.

It goes without saying that the cavity should be sterile, or nearly so, before the muscle is placed in it. In the case of extensive cavities the "unroofing" by means of resection of the ribs and thickened parietal pleura must be done in several stages. In order to get enough material to fill the cavity it is important to plan the operation so as to utilize every bit of muscle possible. A very useful method of obtaining added bulk of muscle is to make a second incision at right angles to the one which has been placed at the lowermost border of the empyema cavity, to reflect the skin flaps thus formed, and to cut the muscle which is to be utilized at a considerably lower level. Several inches of muscle may be gained in this way. The intercostal muscles should be carefully preserved when possible and likewise utilized as a "fill." They are especially useful to plug bronchial fistulas. If the cavity is not too deep they may be preserved intact and allowed to fall into the floor of the cavity. The author also advocates stripping the thickened pleura from the underside of the intercostal muscle and excising it rather than using it together with the muscle, for the pleura may be riddled with small sinuses leading to minute abscess cavities, and, if preserved, these may reinfect the cavity or the wound. Conditions such as these may well be the cause for "the recurrent chronic empyema." Moreover, in tuberculous empyema, which constitutes from 10 to 13 per cent of chronic empyemas, the parietal pleura practically always is the site of tubercles or tuberculous granulation tissue.

Unless the empyema cavity is very large, relatively little deformity is present after the operation. The author has found the use of pedicled muscle flaps to be very satisfactory in dealing with the persistent chronic empyema cavity; in the closure of extrapleural cavities resulting from the excision of cold abscess of the chest wall; in the cure of chronic lung abscess; and in the secondary closure of infected thoracoplasty wounds in which an extrapleural cavity remains beneath the scapula.

MATHIAS J. SEIFERT, M.D.

THE RÔLE OF GASTROSCOPY IN THE RECOGNITION AND IDENTIFICATION OF GASTRIC LESIONS

Collective Review

RUDOLF SCHINDLER, M.D., Chicago, Illinois

UNTIL 1932 diagnostic gastroscopy was correctly considered to be dangerous and therefore was carried out by only a few research workers (Schindler, Korbsch, Gutzeit, Moutier, Henning, Hohlweg). However, since 1922, these few men have developed the knowledge of the endoscopic pathology of the stomach. When in 1932 the safe flexible gastroscope was invented and brought on the market (76), the soil was well prepared and proved to be fertile. Rodgers (69) describes in an amusing manner the sudden gastroscopic invasion of England. Gastroscopy—having been for reasons of manufacturing a purely German matter for decades—conquered the Anglo-Saxon countries at the same time, namely in the fall of 1934. In 1936 and 1937 the method was generally accepted. Resistance was almost nil. In the following abstract the gastroscopic literature of 1937 will be reviewed; some books and papers of the preceding years cannot be omitted entirely.

The expression of the sudden importance of the new diagnostic method was the appearance of four textbooks. Henning's (36) small book has been translated very well by Rodgers (69). It briefly demonstrates the usefulness and possibilities of gastroscopy to those who do not desire to carry out examinations actively themselves. The textbooks of Moutier (58) in French, of Gutzeit and Teitge (35) in German, and of Schindler (82) in English cover the entire field. They describe the development and technique of gastroscopy in detail; they discuss the aspect of the normal and diseased stomach; they compare the endoscopic findings with the clinical pictures and with the results of other examination methods, especially with the x-ray examination; and they emphasize the many new conceptions of gastric disease which have been developed according to gastroscopic observations. The three books are illustrated by numerous colored pictures and form together a gastroscopic atlas.

After the appearance of these books three editorials appearing in the most representative medical journals of the English-speaking world described gastroscopy as an "established" method. The editorial in the *Lancet, 1937, p. 1200*, contained the following sentence: "It is . . . reasonable to urge that every large hospital should possess a gastroscope and an experienced gastroscopist. The latter is not made in a month or two . . ." The editorial of the *Medical Journal of Australia, 1937, 24: 267*, equally emphasized the value of the new method. The *Journal of the American Medical Association, 1937, 110: 373*, published a thorough review on the significance of gastroscopy closing with the sentence: "Again science and medicine have benefited by the developments that have featured the coming of the machine age."

Papers on gastroscopy can be subdivided into three great groups. Many still have to be considered as introductory papers; they discuss the special technique, the indications, contra-indications, and findings. In the second group extensive gastroscopic observations are published. The third group reports clinical observations and research studies in which gastroscopy has been used as an indispensable procedure not needing any discussion or explanation. The most important group of these papers was read before the Second International Congress for Gastro-Enterology, Paris, November, 1937 (27). The main subject was: "The Early Diagnosis of Gastric Carcinoma," and there was almost unanimity among the speakers that gastroscopy would play an outstanding rôle in the fight against the most common cancer.

Though not belonging to the time we are reviewing, Benedict's (5) excellent introductory paper must be mentioned since this author was the first to introduce gastroscopy in the United States. It was fortunate for the method that the first man to transplant it here was not only a good technician but also a careful and critical physician. His clinical papers will be mentioned later. The first man to recommend gastroscopy in England was Edwards (28).

The most thorough of all summarizing papers was that of Schloss (90). It would replace a small textbook and, since it is readily accessible, it can be recommended strongly to those surgeons and

internists who would inform themselves superficially about gastroscopic questions. The papers of C. and C. L. Jackson (39); and Schindler (77, 78) which appeared in 1935 and 1936 will be mentioned. In the beginning Jackson thought that peroral esophagoscopy should precede flexible tube gastroscopy. It seems, however, that now he has abandoned this standpoint which would have jeopardized the development of gastroscopy decisively. Also, Freeman (29, 30), who at first combined the safe gastroscopic procedure with the dangerous esophagoscopy, now has separated the two methods distinctly. Excellent introductions were given also by Borland (12, 13), Horan, (38), Geier (34), and Carey (14). Ortmayer (65) published a list of indications for gastroscopy later to be rendered in detail. Other introductory papers were written by Moersch (55), Rossi (72), Jutras (42), Thorlakson (97), Kerkhoff (48), Rose (71), and Barnett (3, 4).

In all these publications there is almost unanimity concerning the special technique. The following discussion is based on the books and papers mentioned.

THE HISTORY OF GASTROSCOPY

The history of gastroscopy started in 1868 when Kussmaul first introduced open long rigid tubes into the stomach of a swordswallower. The second period of the development of gastroscopy began in 1881 when Mikulicz recognized that gastroscopy had to follow the optical principles of cystoscopy because the stomach is a large cavity at the end of a relatively thin long tube. He built a rigid angulated gastroscope bearing an electric lamp at its tip; the objective collected the rays coming from the gastric wall and deviated them into the axis of the instrument; the picture obtained was inspected through the ocular. The optical data of this type of instrument improved rapidly. The instruments of Loening-Stieda (1909) and Elsner (1911) gave beautiful, sharp, upright, correct-sided pictures. However, with rigid instruments often only a very small portion of the stomach could be seen. Moreover, all these instruments were dangerous. Even when the contra-indications were carefully observed, fatal ruptures of the esophagus were possible. Therefore, gastroscopy remained an experimental method in the hands of a few selected workers. Some gastroscopists (Kuttner, Kelling, Sussmann, 1911) tried to overcome the difficulties by constructing tubes which were introduced into the stomach when flexible and which were straightened after introduction. This straightening proved to be still more dangerous than the introduction of entirely rigid instruments. These tubes were quickly discarded. This type of flexible instrument should not be confused with the flexible gastroscope of today; the latter does not require straightening but remains flexible during the examination. The third period of gastroscopy began in 1922. Gastroscopy with rigid instruments was taken up as a daily method of examination (75); the numerous endoscopic pictures were described carefully and were compared with the clinical symptoms. All gastroscopists checked their findings by operations and autopsies and compared them with the results of x-ray examination (Schindler, Gutzeit, Rahnenfuehrer, Hohlweg, Moutier, Korbsch, Henning, and many others). This was the spring tide; every day brought new discoveries and conceptions, which only now begin to penetrate into the consciousness of the medical world. Especially the discovery of the frequency and importance of the entity "chronic gastritis" was to have great practical consequences. The last and probably final period started with the invention of the safe flexible gastroscope in 1932 (66). The immediate result was that gastroscopy spread over the world. Gastroscopies now are carried out in the medical centers of Mexico, Argentina, and Australia, and even in Manchukuo and in Italian Somaliland.

THE INSTRUMENT

The Wolf-Schindler flexible gastroscope is the generally used, standard instrument (Fig. 1).

The tip of this instrument consists of a very elastic rubber finger which is most essential for the full utilization of the flexibility of the instrument. The finger bends as soon as it touches the gastric wall, and thereby bends the flexible portion of the gastroscope in the esophagus. Henning replaced this finger at first by a round rubber sponge, later by an elastic rubber ball. Neither leads the instrument, the former being especially objectionable because it causes dangerous friction (see below under "dangers"). Only the finger tip should be used. Some experienced gastroscopists, notably Moutier (58), contend that the introduction of the finger is more difficult than that of the ball. This, however, is a matter of habit, and the safer tip should not be given up for a dangerous one because of the technique of the gastroscopist.

The finger is attached on the small electric bulb. The lamp with the rubber finger may be screwed off and replaced if necessary. This, however, happens but rarely. The modern electric lamps have an almost eternal life. Different models exist. In one of them the glass of the lamp is

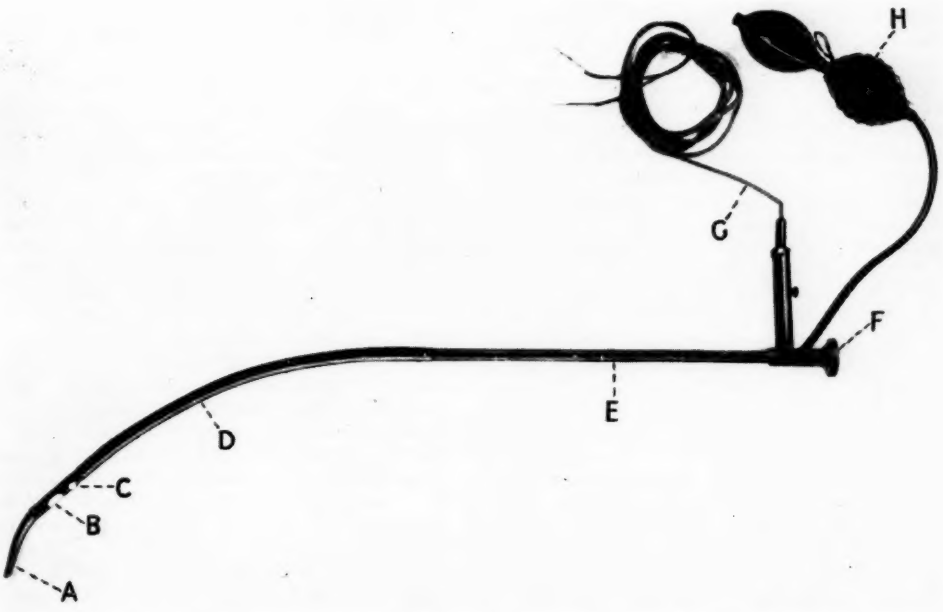


Fig. 1. Wolf-Schindler flexible gastroscope; A, rubber finger; B, electric lamp; C, objective; D, flexible part; E, rigid part; F, ocular; G, electric cable; and H, air balloon.

bulged out so much that it sometimes becomes an obstacle to the introduction. The last model, showing a wide flat glass window, is very satisfactory. The objective window is the "highest" point of the gastroscope, i.e. the objective window lies about 1 mm. above the level of the gastroscopic circumference. This fact is important. In gastroscopy with the rigid gastroscope one of the greatest difficulties was to get the objective into the stomach in an unsoiled condition. The old Elsner gastroscope of 1911 was impractical because the objective usually became dirty. It was found, then, that it was possible to clean the objective by wiping it off at the protruding posterior wall of the stomach. In order to facilitate this procedure the objective of the flexible gastroscope was built as an elevated area; and then it was found out that this elevation usually came into the stomach clean because it was wiped off at the cardia—an astonishing progress over the older systems. The prism of the objective deviates the rays coming from the gastric wall into the axis of the gastroscope. Here two different angles must be distinguished, which usually are confused by the beginner. The objective collects a cone-shaped bundle of rays, and the middle ray is broken into the optical axis of the instrument in an angle which corresponds with the optical data of the special instrument. Although Henning recommends "retrograde" and "prograde" optical systems, they have been discontinued now. That instrument in which the middle ray is broken by 90° has become the standard instrument. The outer rays of the bundle which is permitted to enter the instrument include another angle, the "visual angle." Two different "visual angles" are used at the present time. The "wide angled" instrument has a visual angle of 85°. It is still considered to be the standard instrument, but probably it will be replaced by the newer 50° instrument which has a smaller visual angle but a better magnification than the 85° instrument. The latter will remain useful in postoperative stomachs.

The objective is followed by the lower flexible portion of the gastroscope, the upper end of which is still several centimeters above the cardia even if the instrument is introduced to its full length with the ocular piece touching the teeth. The flexible portion is made of a very hard steel tube cut in a long spiral which is at the same time very flexible and very elastic, i.e., having the

tendency to regain its former shape and position. It contains numerous systems of thick convex lenses. The picture formed by the objective lenses is given from one focal point to the next one, a bending of the tube to an angle of 34° in several different planes being permissible. The spiral metal tube is covered by two rubber hoses which prevent dust from entering the optical system and between which air, necessary for the distention of the stomach, can pass. The flexible portion is fastened to the upper rigid portion which bears the ocular piece. The diameter of the rigid part is only 8.5 mm. The air balloon and the electric cable are attached to the ocular piece. The result of this complicated optical system is an upright, right-sided, entirely sharp picture which is obtained when the bending of the instrument does not transgress 34°; almost all portions of the stomach are usually visible, except three blind spots: namely, a portion of the lesser curvature of the antrum, a portion of the lower pole of the stomach, and that strip of the posterior wall on which the instrument is lying.

Recent attempts to improve the standard instrument have considered these blind spots. Rodgers' (70) device probably will have great importance. It originally consisted of a special rubber sheath, carrying an inflatable rubber balloon situated just proximal to the window of the objective and connected by a capillary rubber tube to a bulb at the upper end of the instrument. When the balloon was inflated by squeezing the bulb it lifted the gastric mucosa out of contact with the objective and enabled it to be inspected satisfactorily. This original model did not work because the rubber was too soft. However, the idea was good. Therefore, Wolf built a similar balloon which is connected with a very short piece of rubber tube in order to avoid an increase in the diameter of the instrument. The balloon is connected with the bulb by a capillary rubber tube and gets the necessary volume when the bulb is compressed entirely. This usually makes possible good visualization of the posterior wall, cardia, and even the esophageal mucosa. Some patients contend that the loose capillary rubber tube irritates the throat; moreover, the introduction of the instrument with this device attached is more difficult than without it. Nevertheless, this offers the possibility of visualizing ulcers of the posterior wall and of the lesser curvature in which the differential diagnosis between benign ulcer and carcinoma should be made. For this reason Rodgers' device is a definite progress.

A Japanese factory (Takei in Tokyo) has tried to imitate the Wolf-Schindler gastroscope, but it seems that with the exception of Kirihara and his co-workers (49) nobody has used it as yet so that it is impossible to tell whether or not its accessories (rubber, metal spiral, lens system) are of the same good quality as those of the original. This instrument, however, has some modifications which should be mentioned. A metal wire permits a slight active bending of the lowest portion of the flexible part. The intention of this construction is to improve the visualization of the pylorus by bending the tip toward the pyloric region. It is impossible to tell whether this goal has been attained. Complicated mechanical devices are apt to increase the fragility of the instrument. The pylorus can be found with the German standard instrument at least as often as indicated in the Japanese statistics—by the experienced examiner even more frequently. Only comparative examinations with both instruments could show whether a definite advantage is obtained and, if so, whether it is not overpaid by an increased fragility. The second construction, a photographic camera, will be mentioned in a later paragraph on gastrophotography.

Gutzeit and Teitge (35) in their excellent book still recommend the rigid gastroscope by Korbsch. They contend that the optical data of rigid instruments necessarily are superior to those of flexible instruments and that no accidents have occurred with rigid instruments in the hands of Gutzeit. The first reason is not of great importance after the afore-mentioned construction of the new 50° flexible instrument. So far as the second reason is concerned, thousands of examinations may be carried out without any accident by skillful and careful examiners (the reviewer himself had no accidents from 1923 to 1932). With the rigid gastroscope, however, a mishap may occur virtually at any moment. Because of this hidden danger, the flexible gastroscope had been constructed. When the newest Korbsch instrument came into use fatal mishaps were immediately observed (see below under "dangers"). Thorlakson reported such accidents (97). With the strongest possible emphasis, therefore, gastroscopists should be warned not to use any type of rigid instrument for diagnostic purposes.

THE TECHNIQUE OF GASTROSCOPY

A standard technique has been developed which, with slight modifications, apparently is used everywhere.

Diagnostic gastroscopy does not require hospitalization except in cases of pyloric obstruction in which a thorough lavage is necessary on the evening before the examination. The patient

has to be without breakfast. Some gastroscopists still give morphine before the examination; others refuse to use it, contending the patient should be able to relax voluntarily and, therefore, should not be drowsy. Usually small amounts of codeine and atropine are given to reduce the reflexes. A thorough anesthesia of the throat is obtained by the use of a 2-per-cent pontocaine solution to which adrenalin is added. It is administered everywhere by the Schindler hypopharynx tube. The stomach then is emptied through an Ewald tube, in a modified Trendelenburg position. These preparations take about twelve or fifteen minutes; the following gastroscopy about three or five minutes. In two hours usually six examinations are carried out.

The left-side position is generally accepted. All other positions have been proved to be less satisfactory. The patient should be entirely relaxed, his head hanging down and supported by the left hand of the assistant. Some examiners, especially Benedict (5), work without an assistant. This requires exceptional skill. Anyhow, no assistant is better than a bad one. There is general agreement that the personality and skill of the first assistant are of fundamental importance. A continuous change in nurses should not be permitted. The first assistant can be replaced as little as the head nurse of an operating room. Some examiners work with special tables, especially Henning (36) and his pupils, but it seems that the results obtained with less expensive tables are equally satisfactory. There are differences in the introduction of the gastroscope. One school introduces the flexible gastroscope in the same position in which rigid gastroscopes were introduced, i.e., from the beginning on in the axis of the body of the patient, the head being extended. The other school prefers to utilize fully the flexible quality of the instrument and to start the introduction with the instrument lying perpendicular to the long body axis; only when the rigid portion approaches the teeth the gastroscope is swept over the quarter of a circle and brought into the body axis. In this position the patient is less apprehensive than with extended head; the rubber covering the instrument does not touch the teeth, therefore the friction is almost nil. Other differences are noted in the position of the left hand of the operator. While some have this hand in pronation pulling the tongue forward with one or two fingers, others contend that in this way it is possible to enter the trachea and, therefore, the left hand should be in supination, so that the operator looks in his palm. The left index finger then gently pushes the rubber tip of the gastroscope toward the posterior wall of the pharynx and prevents it from slipping down in the left piriform sinus. The last but most important difference concerns the speed of introduction. Some observers, especially esophagoscopists, go ahead very slowly. Others, especially Schindler (82), lay strongest emphasis on the necessity of a speedy, though careful, introduction. They think the instrument should reach the lowest depth of the stomach within three seconds; then there will be no time for the formation of spastic contractions. If this is true, it is not astonishing that Kirihara (49) had great difficulties in finding the pylorus because he recommends very slow and gradual introduction of the instrument. After the introduction, air is inflated into the stomach, the electric current is switched on, and the inspection begins. There is unanimity that introduction of the instrument is easy, but that orientation and interpretation are very difficult. Long experience is needed to enable the examiner to form correct conclusions. Therefore, the statistics which are published by beginners and which are based only on some hundred cases are only of very doubtful value.

INDICATIONS

The indications as listed by Ortmayer (65) give the best idea of the usefulness of gastroscopy. These indications quoted here extensively are not based on theory but gathered from observation of nearly 500 cases:

"1. Any patient with an obscure abdominal complaint, who has had a negative physical, laboratory, and x-ray study should be gastroscoped. A gastric lesion too small or too shallow to be seen with x-rays may be present.

"2. Anyone with digestive symptoms, "dyspepsia," who has been called neurotic, should be gastroscoped before being sent to the psychotherapist. Such a patient may have atrophic gastritis, or even early carcinoma.

"3. Likewise, a patient with unexplained loss of weight, loss of appetite or nausea, may have an early gastric lesion and should be gastroscoped.

"4. Unexplained hematemesis or melena constitute definite indication for gastroscopy. Very small shallow actively bleeding gastric erosions may be found or large mucosal hemorrhages. These latter may arouse the first suspicion of abdominal purpura.

"5. A patient who had a positive x-ray, i.e., one in whom gastric or duodenal pathology has been found, should be gastroscoped for a number of reasons:

"a. to confirm a difficult diagnosis.

"b. to confirm a doubtful diagnosis.

"c. to aid in the differential diagnosis between malignant and benign gastric ulcer. Definite differences in the gastroscopic appearance of the floors of these ulcers may be found.

"d. If a positive clinical diagnosis of gastric carcinoma has been made, to aid in determining its resectability, when no metastases have been found in the tissue elsewhere. Carcinoma with sharply defined edges localized in a favorable region in the stomach, should be resectable.

"e. After a clinical diagnosis of duodenal ulcer is made, in order to determine whether the patient has additional gastric pathology. The duodenal lesion, of course, cannot be seen through the gastroscope, but a duodenal and gastric ulcer have been known to occur in the same patient and the latter found only by gastroscopy, or, a gastritis may accompany duodenal ulcer, as it frequently does. Severe gastritis will certainly influence the prognosis and duration of therapy for the ulcer.

"f. Patients in whom pyloric obstruction is found—the gastroscopist can also aid in determining the cause of the obstruction, whether cancer or ulcer, and thereby facilitate the sometimes difficult choice between gastrectomy and gastroenterostomy, so important in patients weakened by vomiting and undernutrition.

"6. Any patient in whom gastritis has been diagnosed or clinically suspected should be gastroscoped. Gastroscopy is the only exact way of making this diagnosis. Very exceptionally x-ray can correctly demonstrate chronic hypertrophic gastritis in its severest forms, not otherwise. Clinicians were handicapped for years in the diagnosis of chronic gastritis, for lack of proofs of its existence in the living patient, until the gastroscopists demonstrated its frequent occurrence.

"7. Any patient for whom exploratory laparotomy is contemplated should be gastroscoped. The 'exploratory,' in contemplation always disappointing to the patient and in retrospect frequently so to the surgeon, may thereby be transformed into a therapeutic operation or be avoided altogether.

"8. Gastrectomized patients should be gastroscoped at regular intervals after operation, in order to determine as early as possible whether there is a recurrence of the original lesion.

"9. After gastro-enterostomy at regular intervals.

"10. Patients with blood dyscrasias should be gastroscoped. Pernicious anemia is accompanied by all grades of atrophic gastritis and has shown to yield to liver therapy.

"11. Patients with known atrophic gastritis should be gastroscoped at regular intervals. It is thought by some to be the forerunner of gastric carcinoma. (This indication seems especially important if one takes into consideration the result of the discussion on gastric carcinoma at the Second International Congress for Gastro-Enterology, Paris, November, 1937. Rev.)

"12. Patients in whom the rarer lesions of the stomach may be present should be gastroscoped. Too little is known, before post mortem, of gastric tuberculosis, syphilis, lymphoblastoma and other granulomas.

"13. Lastly, there is the very important indication of the gastroscopic follow-up during therapy of gastric carcinoma, gastric ulcer, and chronic gastritis."

CONTRA-INDICATIONS

These have been listed satisfactorily by Barnett (3) who writes that the contra-indications may be divided into two classes:

1. Real contra-indications
   a. Esophageal varices
   b. Obstruction of the esophagus (and of the cardia—Rev.) either intrinsic or extrinsic
   c. Aortic aneurysm
   d. Corrosive gastritis
   e. Esophageal diverticula (This, in the experience of the reviewer, is no absolute contra-indication.)
2. Relative contra-indications
   a. Angina pectoris
   b. Dyspnea
   c. Psychosis
   d. Severe curvature of the spine
   e. Cardiospasm.

It should be mentioned that the most important real contra-indication, obstruction of the esophagus, or of the cardia, should not be excluded by the x-rays (which sometimes fail to show the obstruction), but by the introduction of a thick Ewald tube.

DISCOMFORT CAUSED BY GASTROSCOPY

There is almost unanimity that gastroscopy carried out with the flexible gastroscope causes only very little discomfort in co-operative patients. It certainly is much less than that caused by cystoscopy in the male. All gastroscopists have been able to examine their patients repeatedly. The highest number of examinations carried out in one man—65—has been reported by Schindler (80). From 15 to 25 examinations are frequent. It is well known that patients who have had a diagnostic esophagoscopy almost never consent to a repetition and it is difficult to per-

suade such patients to undergo gastroscopy. If, however, they do undergo gastroscopy, they then insist that esophagoscopy and gastroscopy should not be compared. In stiff and spastic patients soreness of the throat lasting from one to four days is sometimes observed. The discomfort depends upon milieu and origin. Borland (12) found that it is often difficult to perform gastroscopy on colored people. Schindler (82) had difficulties with the first generation of European immigrants, but stated, however, that the second generation were as co-operative as Americans usually are. Psychoneurotics often are the best patients. An exceptional statistical study has been published by Kirihara (49). During the examination he found excitement in 4 per cent, dyspnea in 3.8 per cent, pallor and cyanosis in 3.3 per cent, sweating in 20 per cent, and nausea and vomiting in 20.1 per cent (!) of all cases. These symptoms are not observed either in the United States or in Germany. Some Japanese patients form an exceptionally sensitive group.

DANGERS

After the invention of the flexible gastroscope it was believed that every kind of danger had been discarded, provided strict attention was given to the few contra-indications, and that this instrument would be a safe one in the hands of even an awkward examiner. It is, indeed, of utmost importance that diagnostic instruments be constructed in such a way that they are safe not only in the hands of the highly skilled and trained technician, but in the hands of every physician who wants to use them. This was not so with regard to the former rigid gastroscopes and the open tube esophagoscopes. Therefore, it should be emphasized that no lesion of the hypopharynx nor of the esophagus has been observed by means of the flexible Wolf-Schindler gastroscope. When Henning modified an important part of this instrument by replacing the elastic long rubber tip with a round rubber sponge, perforations of the stomach were observed immediately. Five such lesions have been reported, which occurred in a very short period of time. Fortunately all of the patients recovered. After the Henning sponge had been discarded, this type of injury was never observed again in ten thousands of examinations. Schindler and Renshaw (87) showed experimentally that two factors had been responsible: (1) the sponge caused an excessive friction on the surface of the stomach, and (2) the sponge tip had not the quality of the finger tip of leading and bending the flexible part over the posterior gastric wall, the finger tip alone being able to distribute the pressure of the instrument over a broad area. After the re-introduction of the finger tip, flexible tube gastroscopy became an entirely safe procedure.

It would be scarcely worthwhile to report this development in detail at this time, except that the danger of mishaps might be increased by Gutzeit's continued recommendation of Korbsch's rigid gastroscope. In very skilled hands this thin rigid instrument is probably safe, but virtually it is as dangerous as any other rigid instrument. With the former rigid instruments mishaps were very rare (Gutzeit himself never had an accident, a fact probably responsible for his attitude), but the virtual possibility of mishaps did not permit gastroscopy to become an "established method." Mishaps with Korbsch's instrument are not only theoretically possible; they have been observed practically. There are only very few such instruments used in the United States and in Canada, but, nevertheless, already 3 mishaps, 2 of them fatal ruptures of the esophagus, have been observed (Thorlakson, 97). Gastroscopy as an indispensable daily method of examination will be again discredited if the Korbsch instruments are not abandoned.

A few words should be said concerning the dangers resulting from the use of pontocaine for anesthetization of the pharynx. Pontocaine seems to be the best substitute for cocaine for the anesthetization of mucosal surfaces. The reviewer regularly used 10 c.cm. of the 2 per cent solution together with 10 drops of the usual 1:1000 solution of adrenalin or suprarenin; he never observed the slightest symptom of intoxication. However, he has been told by Carey (16) that a death occurred under the fully developed symptoms of cocaine poisoning. It seems that 2 similar cases have been observed in Germany and in Italy, respectively. Although this mishap evidently is a kind of curiosity, the careful examiner will prefer to protect his patient and himself by keeping at hand an antidote (1 ampoule of pentothol sodium with distilled water, or evipan). This should be injected intravenously when the slightest signs of cocaine poisoning are observed.

THE VALUE OF GASTROSCOPY AS COMPARED WITH LABORATORY METHODS

Almost all authors, Henning, Moutier, and Gutzeit (36, 58, 35), agree that gastroscopy should be the last examination to be used on patients suffering from abdominal distress. They contend that the usual methods (gastric analysis and examination of the stool for occult blood) should be car-

ried out first, gastroscopy complementing the picture thereby obtained. It seems that Schindler (82) alone refuses to compromise and definitely disagrees with this opinion. He contends that the laboratory methods have failed almost completely to help in the diagnosis, prognosis, and therapy of gastric diseases. He admits that histamine negative anacidity points to the absence of ulcer, and the presence of free hydrochloric acid to the absence of pernicious anemia; but with these two statements the realm of laboratory methods is already exhausted. The making of a functional diagnosis does not help to make a prognosis or to institute intelligent therapy. Histamine-proved anacidity may be found in entirely healthy people, in psychoneurotics and psychotic individuals in whom the stomach itself should not be treated, in individuals with superficial, atrophic, and hypertrophic gastritis, although the prognosis in these three conditions would be a very different one, and in individuals with gastric syphilis, benign tumors, and, especially, carcinoma. He believes that the examination of the stool for occult blood is of little value for early diagnoses. He thinks that Moynihan's famous statement on the superiority of the anamnesis over the laboratory tests was correct at that time, but that now we know that for an early diagnosis the most careful case history usually is insufficient. Only the combination of the two anatomical methods, roentgenography and gastroscopy, is reliable. Only by these methods an early accurate diagnosis and differential diagnosis becomes possible.

The relation of roentgenography to gastroscopy will be discussed later.

CLINICAL PAPERS

Some of the published papers are not fully satisfactory because their content is based on too little experience. It seems that one needs the experience of from 200 to 400 gastroscopies before one is able to get everything out of the method, especially to regularly visualize the antral region and to properly interpret the pictures seen. Therefore, the statistical data given by Kirihara (49) are not entirely convincing. Taylor's paper (95), suffering from the same handicap, is, nevertheless, an important one. The author in discussing the history of gastroscopy has omitted its most important part in an almost inexcusable manner, but the clinical part, comparing 66 gastroscopic observations with subsequent gastric operations, is so instructive that its abstract will be included later. Royer, Bur, and Montejano (73) have introduced gastroscopy in Argentina. Their paper is based on 342 examinations. In 5 per cent an observation of the stomach was impossible. They were not able to find the antrum in 37.8 per cent. They group the diffuse diseases of the gastric mucosa as follows:

a. Erosions and ulcerations
b. Submucosal hemorrhages (purpuras)
c. Atrophic lesions
d. Hypertrophic lesions
e. Other forms of gastritis

The authors have compared their findings carefully with clinical observations and have given extensive interesting tables. Their experiences in 6 cases of resected stomach correspond with those of other authors. Only once they found a normal mucosa; in 5 instances a severe gastritis was observed. That they do not exaggerate the pathological findings is proved by the fact that they found a normal mucosa in not less than 25 instances among 51 cases of "hyposthenic and hypersthenic dyspepsia." Of great importance are the gastroscopic observations made in appendicitis and cholecystitis. In 5 of 6 cases of appendicitis the gastric mucosa was found to be normal, but in 1 case an erosive gastritis was seen. (This strange coincidence of acute appendicitis with erosive gastritis has been observed by the reviewer also. Further checks seem to be indispensable.) Unusually extensive material of cholecystitis has been examined by the authors. Their 50 patients in this group surpass the number examined gastroscopically even by Henning and Gutzeit. They found gastritis or other mucosal changes in 22 cases. Of the same importance is their observation that gastritis was combined with colitis in 3 of 9 cases. It is to be expected that the authors will publish this interesting material more extensively.

Ayala Gonzales (2) has introduced gastroscopy in Mexico. Three colored plates containing 39 pictures—though not very satisfactorily reproduced—show the abundance of material on which the author's paper is based.

ULCER

There is unanimity that gastroscopic examination is less useful in ulcer than in the other two major diseases of the stomach, gastritis and carcinoma. The duodenal ulcer and the ulcer of the pyloric channel can be found only by x-ray relief technique. The prepyloric ulcer only rarely can be seen through the gastroscope. The true gastric ulcer gives a striking picture (Fig. 2). Its healing process and its coming and going may readily be observed with the gastroscope. The gastric ulcers of the blind strip of the posterior wall usually will be overlooked, although Rodger's sheath (69, 70)

may aid in their diagnosis. Some ulcers are found gastroscopically which cannot be demonstrated with the finest x-ray relief study. The diffuse changes of the gastric mucosa in ulcer-bearing stomachs are well seen. For this reason gastroscopy becomes a necessity for the surgical therapy of gastric and duodenal ulcers. Schindler (81) describes the value of gastroscopy in gastroduodenal ulcer in the following statements:

"1. Gastroscopy reveals gastric ulcers not demonstrable with other methods.

"2. The success of medical treatment, complete epithelization, can be determined only by gastroscopy.

"3. Gastroscopy usually permits the differentiation between benign and malignant ulcer of the lesser curvature.

"4. Early diagnosis of very small carcinomatous ulcers and their successful surgical treatment would more often become possible if each patient, over thirty-five years of age and in whom a crater of the lesser curvature had been found roentgenologically, would be gastroscoped.

"5. The extent of inflammation accompanying gastroduodenal ulcer can be determined only gastroscopically. It may be of decisive influence upon the indication for operation. Probably the surgeon would not operate on an inflamed area because he would be afraid of the gastritis that might develop later in the postoperative stomach.

"6. The source of gross hemorrhage may be determined gastroscopically. The respective findings either facilitate surgery or prevent it."

Some points need amplification. With regard to Statement 2, usually, but not always, the disappearance of the roentgenological niche coincides with the epithelization of the ulcer as observed gastroscopically. Uhlenbruck and Norpoth (99) used gastroscopy to check the final epithelization of gastric ulcers after treatment with larostidine. They were critical enough to admit that such an observation does not prove the effectiveness of the drug. This certainly is correct since the same effect may be obtained from the most varied methods of treatment.

With regard to Statements 3 and 4, the possibility of differentiating between benign and malignant ulcers by means of gastroscopic observations is one of the most important and amazing advantages of gastroscopy. Skeptics don't believe these statements. They think what cannot be seen macroscopically in the gross specimen cannot possibly be seen with the gastroscope. They forget that in gastroscopy the blood is still circulating, a fact which makes the edge and often the floor, also, of the malignant ulcer differ distinctly from those of the benign ulcer. The skeptics argue further—microscopically we often find nests of cells in the deeper layers of the ulcer wall of the apparently benign ulcer which prove that it is not benign but turning malignant. With this argument they again forget the clinical facts. Histologists believe that from 20 to 50 per cent of all apparently benign ulcers are malignant (Staemmler, 92 and Bertrand, 10) in this histological sense. The clinician who uses the gastroscope, however, obtains another picture. If he decides that the ulcer, according to the gastroscopic picture, is a beginning carcinoma, then the course will show that he was right (83), and when he contends that the ulcer is benign, then the course will be that of a benign ulcer. The clinician who is well experienced in gastroscopy will probably see no benign ulcer turn into a malignant one. (The gastroscopic beginner and the clinician relying solely on the x-rays will make mistakes.) If this is true—apparently all gastroscopists have had similar experiences—if 100 gastroscopically benign ulcers can be observed over a period of from two to ten years without 1 of them turning into a malignancy, then evidently less than 1 per cent of all benign ulcers turn into malignancies. In this event gastroscopic diagnosis must necessarily be superior even to microscopic studies, or to put it better, the microscopic criteria of benignity and malignancy of an ulcer have not yet been established correctly and the histologist must learn from the endoscopist what he should consider as benign and what as malignant.

As to Statement 5, the importance of accompanying inflammation for the prognosis of gastric surgery in ulcer is usually not sufficiently appreciated. Also, endoscopic and histological concepts do not agree (79) and have to be accommodated to each other. Sometimes no inflammation at all is present; often inflammatory swelling around the ulcer is found; rarely all portions of the stomach are inflamed. Isolated antrum gastritis may be found in cases of chronic organic or spastic obstruction of the pylorus. Ulcerative antrum gastritis is not found in true gastroduodenal ulcer. R. Chevallier (21) describes and illustrates 2 cases of gastric ulcer with an operative check. In one of them a severe hypertrophic gastritis around the ulcer was observed, but in the other no inflammation was seen. Histological examination, in the last instance, confirmed the endoscopic finding.

With regard to Statement 6, gross hemorrhage coming from an unknown source is one of the most important indications for gastroscopy (Benedict, 9). It may come from an overlooked ulcer, from beginning carcinoma, from benign tumors, espe-

cially myomas (Fig. 3), as well as from non-surgical diseases, such as syphilis, hemorrhagic non-inflammatory erosions, and ulcerations of the different types of gastritis; in these cases of gastritis a fatal outcome has been described repeatedly (Fig. 4). In a case of duodenal ulcer with bleeding, gastroscopy revealed that not the ulcer itself but a very small gastric hemorrhagic erosion was bleeding profusely. Therefore, gastroscopy is indicated even if the source of bleeding seems to be known. Gastroscopy has been feasible as soon as the third day after a profuse hemorrhage and probably would be innocuous even if performed during the hemorrhage.

GASTRITIS

There is general agreement as to the statement that discovery of the frequency and importance of chronic non-specific gastritis has been the most valuable contribution of gastroscopic research to general medicine. Chronic non-specific uncomplicated gastritis is found in from 40 to 50 per cent of all patients examined with the gastroscope. However, there is a remarkable lack of papers eliciting new clinical knowledge from the gastroscopic findings. One notes the bewilderment of most workers about the fact that there is apparently no relation between the outspoken endoscopic findings and the chameleon-like changing clinical data (Gaither and Borland, 32). A good survey was made by Stix (93). Research on the cause of this frequent disease had been in vain as yet. In Gutzeit and Teitge's textbook one will find a good compilation of all possible factors and diseases leading to or accompanied by chronic gastritis. Some authors refuse each classification of the many various pictures seen gastroscopically, especially Gutzeit. Others (Moutier, 58) give a very detailed classification based chiefly on the description of the changes seen gastroscopically. However, Schindler's very first classification into three great groups still is widely accepted (Edwards, Benedict, and many others). This classification tries to subdivide the findings according to the course and prognosis. The three varieties are (1) superficial, (2) atrophic, and (3) hypertrophic chronic gastritis. Schindler and Ortmayer (84) admit that there is a relation between the superficial and the atrophic form: superficial gastritis may heal or may turn into atrophy. Whether atrophy can occur without preceding superficial gastritis is not yet certain. Hypertrophic gastritis is considered to be a different entity not tending to heal. Attempts have been made to correlate the endoscopic picture of gastritis with a definite clinical picture (Moutier, 58 and Swalm, Jackson, and Morrison, 94), but the results obtained are neither convincing nor encouraging (86). Luehr (54) described the gastroscopic picture seen in gastritis serosa, a chemical entity described first by Katsch (47). Luehr stated that there was no relation between the gastroscopic and the laboratory findings. There is agreement with regard to the statement that in some cases of infiltrative hypertrophic gastritis the gastroscopic differential diagnosis may be impossible. These are the rare cases of proliferative antrum gastritis leading sometimes to pyloric obstruction and therefore requiring surgical interference. In these cases (0.2 per cent of all cases) the gastroscopist cannot tell the surgeon whether he will find a gastritis or an infiltrative carcinoma (Fig. 5). The roentgenologist also makes a diagnosis of either carcinoma or chronic gastritis.

A rational therapy of chronic gastritis is not known, although many suggestions have been given. Schindler (80) observed a case of severe hypertrophic ulcerative gastritis by repeated gastroscopic examinations over a period of ten years and then tried high-voltage x-ray therapy with a very good result. One year later, however, severe gastric atrophy developed.

René Chevallier (23) has studied a disease he does not classify under chronic inflammations. He observed tremendous localized edema of the gastric mucosa in allergic individuals, the chief characteristic of which was its inconstancy. Often he found accompanying mucosal hemorrhages. At x-ray examination a cancer was sometimes simulated and only gastroscopy permitted the diagnosis. He called this disease "gastrie allergique" to indicate that it was not inflammatory. Schindler has repeatedly pointed out that not all diffuse lesions of the gastric mucosa can be considered inflammatory. He mentioned especially the mucosal hemorrhages, pigment spots, and hemorrhagic erosions found so often in ulcer-bearing stomachs or together with generalized purpura. Paul Chevallier and Moutier called this picture "gastric purpura." The same authors describe rare disturbances of the circulation consisting of the sudden appearance and disappearance of pale and red patches in the gastric mucosa during examination (19). René Chevallier (25) found that ulcer is by no means the most frequent source of gastric hemorrhage, since many other bleeding lesions may be found, such as those caused by inflammations, allergy, and purpura.

CARCINOMA

The most extensive gastroscopic literature is that on gastric carcinoma. This is because of the fact

Fig. 2.

Fig. 2. Gastroscopic view of a benign gastric ulcer of the lesser curvature above the "angulus." At the right side the dark cavity of the antrum is seen. A dark brown pigment-spot lies in the mucosa of the "musculus sphincter antri." The ulcer occupies the middle of the picture. A portion of its edge is undermined.

Fig. 3.

Fig. 3. Gastroscopic view of a typical myoma of the anterior edge of the angulus, in a case of gross gastric hemorrhage. X-ray showed an indefinite filling defect.

Fig. 4.

Fig. 4. Gastroscopic view of three inflammatory erosions in a case of "unexplained" gross gastric hemorrhage.

that the main subject of the Second International Congress for Gastro-Enterology at Paris, November, 1937, was "The Early Diagnosis of Gastric Carcinoma."

Already before this event some important papers on this subject were published. Benedict (7) compared gastroscopic findings with x-ray findings and with biopsy results in 14 cases. In 2 cases the gastroscopic diagnosis of a benign tumor was made and confirmed by autopsy, while the x-rays suggested malignancy. In 1 of the cases a small polypoid growth was suspected upon roentgen examination, while gastroscopy correctly suggested the presence of an infiltrative carcinoma. In 1 case the roentgenologist turned to gastroscopy in order to exclude syphilis, but an infiltrative carcinoma was found. In 1 case the diagnosis of hypertrophic gastritis was made after roentgen examination, but gastroscopy revealed malignancy three months before the radiological diagnosis became possible. In one case x-ray examination and gastroscopy both suggested the presence of an extragastric lesion and in another the extent of a gastric carcinoma. In the other cases the extent of the carcinoma was best determined by gastroscopy. Moutier (59) described gastroscopic pictures which looked like those found in carcinoma. These lesions, however, disappeared after antiluetic treatment and, therefore, had to be considered as being gastric syphilis. This author found that gastric cancers sometimes respond for a short time to antiluetic treatment. Catalanotti (17) discussed the gastroscopic forms of cancer and emphasized the difficulty of interpretation. Taylor's paper (95) has been illustrated by wonderful colored pictures. Twice he observed a benign tumor and thus avoided operation. In 2 cases he found a benign ulcer although carcinoma was suspected clinically. In some cases he believed a carcinoma to be operable, although the operation showed that this was not the case.

This observation leads to an important discussion: if one would try to state the operability of a carcinoma by describing that a strip of mucosa between the cardia and tumor is free of tumor, he would often be wrong. In infiltrative forms the tumor invades large portions of the gastric wall, which invasion cannot be recognized gastroscopically. If the involvement of the upper portions of the stomach is definite, then no further proof is necessary and gastroscopy thus may help to avoid unsatisfactory exploratory laparotomies. However, it is doubtful whether the presence of an area without carcinomatous infiltration is sufficient to warrant operability in more than a purely technical sense. Nothing destroys confidence in gastric surgery more than resections for cancer followed by early recurrence. Schindler (82), Giere (83), and Wirts (89) believe they can judge the operability of gastric cancer according to types which conclusion will be referred to later.

Schindler and Giere (83) tried to show the importance of gastroscopy for the surgeon. Their paper is based on 41 case reports. In 20 cases control by biopsy was possible. They came to the following conclusions:

"Although the gastroscopic diagnosis was confirmed in every case in which we had biopsic control, it must nevertheless be admitted that negative findings in gastroscopy are not entirely conclusive. The differential diagnosis between benign and malignant ulceration is not difficult to determine after a gastroscopic examination by one trained in this field; even in the very early

stage biopsy is not necessary. The differentiation between benign and malignant obstruction is more difficult but also possible. Gastroscopic diagnosis was proved to be correct in each instance (7 cases). The gastroscopic picture is more characteristic than is that of the gross specimen because of the circulating blood. The operability of carcinoma was best determined by gastroscopy (9 cases). Special attention is called to the fact that operation for gastric carcinoma frequently results in cure of long duration, particularly in cases in which the diagnosis is made early. Early gastroscopy together with an early roentgenogram is able to reveal operable carcinoma. Gastroscopy has proved to be superior to roentgen examination in certain cases; theoretically, in other cases, roentgen examination should be superior. The 2 methods are not competitors; each supplements the other and good co-operation between the gastroscopist and the roentgenologist is essential. Early diagnosis of gastric carcinoma can be brought about if each patient over thirty-five years of age who suffers from anorexia or significant loss of weight in whom no other explanation for the symptoms is found is immediately examined gastroscopically and roentgenologically. Patients with atrophic gastritis or a benign tumor should be watched carefully by both methods. An unfavorable diffusely infiltrating carcinoma of the body of the stomach should be recognized by gastroscopy and excluded from operation. Exploratory laparotomy should be done only on those relatively few cases in which the operability is not definitely determined by gastroscopic examination. This will result in a greatly lowered surgical mortality and will thus help to dispel the prejudice which so many hold in respect to the surgical treatment of carcinoma. This should not only bring a greater number of patients with carcinoma to the operating table but also result in the observation of a greater percentage of cases in the early stage, since a distinction will be made in the minds of the public between the prognosis of early and late cancer."

A colored plate illustrates the findings of the authors.

Again René Chevallier (24) made most valuable contributions to this subject. He described very early carcinomas of the pylorus diagnosed gastroscopically, and published a colored plate containing such characteristic pictures that one should look it up in the original.

In this review it is impossible to render adequately all important papers on the early diagnosis of gastric carcinoma read before the Second International Congress for Gastro-Enterology. A short selection shall be given. Katsch (46), the outstanding German clinician, discussed the subject from the standpoint of general medicine. He emphasized, as did almost all subsequent speakers, the tremendous superiority of the x-ray examination and gastroscopy. Gastroscopy, routinely used, permitted surprising early diagnoses, even in some cases in which the x-ray examination was negative. Katsch thinks that epigastric distress, even if it does not suggest cancer, should be analyzed by means of x-ray examination and gastroscopy. Clinical observation of patients suffering from chronic gastritis would be essential. This last statement was also made by Kapp (45) who thinks that as yet x-ray examination and gastroscopy have not improved the early diagnosis of gastric carcinoma because the right material was not examined. He made a follow-up study in 157 cases of chronic gastritis and found that in 13 per cent a carcinoma had developed within from twelve to seventeen years. The chief speakers on the value of gastroscopy were Moutier and Henning. Moutier (61) subdivides the stomach in different "regions." In his experience carcinoma in the region of the body of the stomach always has grown considerably before endoscopy becomes possible, but in the antropyloric region an early gastroscopic diagnosis can be made. He then describes the characteristic endoscopic findings. Henning (37) said gastroscopy may have 3 different aims: (a) the completion of certain positive x-ray findings (the operability of a tumor is much better shown by gastroscopy than by x-ray examination, and numerous explorations with their dangers may be avoided by gastroscopy); (b) the verification of doubtful x-ray findings; or (c) the exclusion or demonstration of a tumor following negative x-ray findings. Henning believes that the routine use of the gastroscope will be indispensable in the future in the early diagnosis of gastric carcinoma. Rafsky (66) found gastroscopic examination an invaluable guide as to whether the patient should be operated upon. Freeman (31) also emphasized that only x-ray examination and gastroscopy are valuable methods for the early diagnosis of gastric cancer, that nothing can be expected from the history, physical examination, gastric analysis, or from a study of the stool. Jutras (43), as radiologist, combined x-ray examination and gastroscopy in a manner worthy of imitation. Okada (64) and Netousek (63) described cases of early diagnosis of gastric cancer made gastroscopically. Bonadies (11) described difficulties encountered in the gastroscopic examination of gastric carcinomas, especially the obscuring of the tumor by hemorrhage and its non-visualization when situated in a "blind

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 5. Gastroscopic view of severe verrucous ulcerative antrum gastritis. Three grayish-yellow ulcerations were seen lying in a thickened stiff nodular mucosa. Resection and microscopic examination revealed antrum gastritis.

Fig. 6. Gastroscopic view of a sharply limited (Type 2) gastric carcinoma of the lesser curvature. The ulcer floor was a dirty gray; the irregular nodular wall was red, sharply limited toward the surrounding pale pinkish mucosa (confirmed by operation).

Fig. 7. Gastroscopic view of a black silk thread which has cut through the gastric mucosa of a postoperative stomach.

area." René Chevallier (26) mentioned the difficulties of an accurate early roentgenological diagnosis, contending that gastroscopy is the superior method in some cases. He described a characteristic gastroscopic syndrome he calls the "Etat cartonné leuco-atropho-amyxique." The rigidity of the infiltrated area is recognized earlier by gastroscopy than by x-ray examination. The color of the infiltrated area is a pale dirty white, often most outspoken in the prepyloric region. In contrast to ulcer there is an obliteration of the folds in early carcinoma. Finally the mucosa is dry; this is a very important early sign. Schindler and Wirts (89) decided to use the expression "early" diagnosis only for those carcinomas which permit a complete cure of long duration. With this as a premise, the presence or absence of symptoms and the site and size of the tumor seem irrelevant. Of importance are only the general condition of the patient, the absence of metastases, and especially the type of carcinoma. These authors accepted Bormann's subdivision into four types, which can be recognized readily by gastroscopy: the polypoid tumor, the localized ulcer, the infiltrative ulcer, and the diffusely infiltrative tumor (Fig. 6). The 2 first types give a good prognosis; the third a doubtful one; and the fourth a bad one. The authors describe a case in which gastroscopy—by this typological diagnosis—proved to be definitely superior to x-ray examination; however, they recognize the equal importance of both methods. Konjetzny (52) again emphasized the multicentric origin of gastric carcinoma in a gastritic mucosa, a view he has defended since 1914 and which now seems to be accepted generally.

The gastroscopic diagnosis of lymphoblastoma has been described by Renshaw (67).

THE POSTOPERATIVE STOMACH

Since Schindler's first publication in 1922 the importance of gastroscopic examination of postoperative stomachs has been fully recognized. Indeed, the diseases of the postoperative stomach, excepting some jejunal ulcers, are best or exclusively diagnosed by gastroscopy. Carey (15) states that "gastroscopy offers the only opportunity of seeing directly such changes in the gastric mucosa as are likely to result from a poorly functioning opening placed in the stomach as part of some operative procedure upon it. These changes include various types and degrees of gastritis and ulceration, and recurrence of malignancy." Schindler and Giere (83) base their conclusions on the observation of 28 patients, 7 of which again underwent operation after gastroscopy. A relatively normal stomach was seen only in 3 instances. Recurrent ulcer was found in 1 case and a jejunal ulcer in 2 cases; simple hemorrhagic erosions were observed twice. Silk sutures which had cut through the mucous membrane and were hanging free into the gastric cavity were observed 3 times (Fig. 7). The most frequent disease of the postoperative stomach is chronic gastritis; it was observed in 15 cases. Gastroscopic examination was unsatisfactory in 4 cases. "An artificial stoma (after resection of gastro-enterostomy) may remain patent or may acquire pylorus-like rhythmic activity. Four stomas of the latter type were seen, 2 after resection and 2 after gastro-enterostomy. It seems quite certain that this pylorus-like adaptation protects the stomach against the development of postoperative gastritis. Although we do not know what conditions favor this development after resection, it does seem that gastro-enterostomies which are carried out in the posterior wall near

the pylorus and close to the greater curvature have a greater tendency to bring about this adaptation. Gastro-enterostomy has the further advantage that the stoma may be closed if necessary. The activity of the gastro-enterostomy stoma in those cases in which a functional adaptation has developed is not timed in the same rhythm as is shown by the pylorus. Silk sutures which have not been expelled into the cavity of the stomach several months after operation should be surgically removed since they irritate the mucous membrane, causing chronic gastritis with painful erosions, and may even play a part in the development of jejunal ulcers."

THE GASTRIC MUCOSA IN BLOOD DISEASES

The most outspoken changes of the gastric mucosa are found in pernicious anemia. Either the entire mucosa is completely atrophic, it shows atrophic patches, or inflammatory changes are found. Jones, Benedict, and Hampton (41) showed in a brilliant study that in some cases the apparently irreparable atrophic gastritis disappeared following liver therapy and that a real regeneration took place. This observation was confirmed by P. Chevallier and Moutier (18), and Lehmann (53). These French authors also observed gastroscopically the gastric mucosa in cases of hypochromic anemia. They, as well as Morrison, Swalm, and Jackson (57), found similar changes which, however, responded to iron rather than to liver therapy. Gastroscopy, probably, will play a great rôle in the observation of the effectiveness of therapy in these diseases.

The gastroscopic picture in the leucemias was studied especially by Gutzeit and Teitge (35). They found severe hypertrophic gastritis in the myeloic form, extensive atrophy combined with leucemic infiltrations in the lymphatic form.

FOREIGN BODIES

Foreign bodies of the stomach do not have great diagnostic significance. Those too large to pass the pylorus are extracted surgically; a few, such as safety pins in sucklings, may be extracted through an open gastroscope (C. and C. L. Jackson, 40, and Tucker, 98). This technique has nothing to do with diagnostic gastroscopy and, therefore, will be omitted.

Moersch (55) diagnosed a phytobezoar gastroscopically. The tumor appeared gray in color, irregular in shape, and definitely pit-marked.

GASTROSCOPY AND X-RAY EXAMINATION

The relation of the 2 anatomical methods of examination of the stomach has been discussed in the textbooks quoted earlier. Each gastroscopist checked his results carefully with the most refined roentgenological methods in order to elicit the limits and advantages of each method. Roentgenologists hesitated a long time before they drew a similar advantage from co-operation with the gastroscopists. This was true especially in Europe where for fourteen years the roentgenologists were loath to consider gastroscopy as an important method. In the United States, however, through the co-operation of Schatzki with Benedict and of Templeton with Schindler, the situation became different. The result was an extensive discussion before the twenty-second annual meeting of the Radiologic Society of North America. The impression of the papers and the following discussion then was summarized by Rigler (68) from the standpoint of the roentgenologist in a brilliant editorial. He wrote: "First of all, it should be clearly understood that the gastroscopic examination supplements rather than competes with the roentgen examination of the stomach. An adequate roentgen study is an absolute prerequisite for an intelligent, conservative endoscopic examination. The practice of gastroscopy, in any community should stimulate an additional interest in diseases of the stomach. Hence, it seems probable that the introduction of this procedure will increase rather than decrease the number of gastrointestinal cases referred to the radiologist. Secondly, gastroscopy creates a new stimulus and a new guide for the activities of the roentgen diagnostician. At one time surgery was the chief factor in the discipline, so necessary to keep us from degenerating into smug complacency. The decline of surgical intervention in non-tumorous lesions of the stomach, together with the realization that inspection and palpitation of the exterior of the stomach give no final assurance of the presence or nature of a lesion, has somewhat modified the salutary effects of laparotomy for determining the value of roentgen conclusions. The development of another method of examination should give the radiologist another desirable control for the accuracy of his findings. Finally, and to the radiologist most important of all, the endoscopic study of the stomach may prove to be an educational force of considerable importance. The unsatisfactory character of the usual gross and histological investigation of the pathology of gastric diseases is well known. The results, to this date, indicate that longer experience with direct inspection of the gastric mucosa in the living individual will teach us many facts about those diseases particularly gastritis, which, prior to this time, have been difficult to elucidate. The gastroscopic observation of mu-

cosal erosions, gastric ulcers, and the various types of gastric tumors should prove of great value in establishing anatomical data to guide us in the interpretation of roentgen observations." It does not seem possible to express the relation of the two anatomical methods with better words.

Kirklin (50), from a theoretical standpoint, compared also the relative merits of gastroscopic and roentgenological examinations. Later, he with Ansprenger (1) published a special, very valuable paper on the roentgenological aspects of chronic gastritis based partly upon comparative gastroscopic studies. The authors came to the conclusions that only a small percentage of cases of gastritis can be diagnosed by roentgen examination, by the demonstration of stiff folds or of the warty granulation of the relief, and that mucosal atrophy cannot be demonstrated by roentgen examination. Schindler and Templeton (88) systematically compared findings of the relief method with gastroscopic observations. They described some of the differences that occur between gastroscopic and roentgenological examinations and offered explanations as to why they exist. Benedict (8) again stated that gastroscopy should not be used as a substitute for x-ray examination, but should be employed as an adjunct to it. Schatzki (74), from the roentgenological standpoint, came to the following conclusions: "If one should be asked to renounce either gastroscopy or roentgenology one would without doubt prefer to keep roentgenology, but the question is wrong in itself. Gastroscopy is an important supplementary method. A diagnostic problem may be difficult to solve by roentgenology and may be no problem at all for gastroscopy and *vice versa*. The correlation of the findings by the two methods has increased our knowledge of the normal and diseased stomach and has helped us in many individual cases." Schloss, Ettinger, and Pratt (91) in the summary of their comparative studies came to results still more favorable for gastroscopy: "For the diagnosis of gastritis, gastroscopy is by far superior to x-ray relief technique. For the diagnosis of stomach tumors and of postoperative changes, x-ray relief methods and gastroscopy supplement one another in an almost ideal way." Templeton and Schindler (96) discussed special problems of ulcer and gastritis as studied by both x-ray examination and gastroscopy. Jutras (43) gives the example of a radiologist who himself practices gastroscopy with excellent results.

Almost all authors agree that x-ray examination should precede gastroscopy. Schindler (82) alone thinks that such a procedure often is not practical, although he considers x-ray examination indispensable in any instance. At least four days must elapse between the x-ray examination and gastroscopy because barium may often stick between the folds and on small erosions for that period of time; gastroscopy disappoints when carried out too early. However, patients, especially out-of-town patients, with minor distress are not willing or able to wait such a long time and in order not to spoil the chief goal, early recognition of a very small cancer, the gastroscopy should then precede the x-ray examination. Then both examinations may be carried out on the same day, the roentgenological immediately following gastroscopy. When sufficient time is available the reverse order is recommendable.

GASTROPHOTOGRAPHY

It is a sad task to review the literature on gastrophotography. Little can be found of the critical spirit with which gastroscopy and the x-ray relief method were built up.

We are badly in need of a recording of the pictures seen with our gastroscopes. The medical world is accustomed to the permanent records of roentgenology by which the results of fluoroscopy may be controlled. Moreover, observation of the quickly moving picture in gastroscopy is difficult; the occasional onlooker does not see anything at all and is inclined to doubt the findings described by the gastroscopist. Elsner and Henning, therefore, have photographed the interior of the stomach through rigid gastroscopes, Henning with excellent results. Although he and Schindler were able to picture the relief of the interior of the stomach and to adequately represent folds, nodules of hypertrophic gastritis, tumors, and such structures as the musculus sphincter antri, the contrast of colors was not shown by the most sensitive black and white films. Gray or yellow ulcerations were not visible.

The pictures obtained with the so-called gastrophotor do not have the slightest likeness to the pictures seen at gastroscopic examination. The gastrophotor consists of a small camera with pinhole openings which when introduced into the stomach exposes eight films. The interior of the stomach is illuminated by a brilliant light. The pictures obtained in this way are mostly lunar landscapes. There is no similarity to the pictures obtained by photography through rigid gastroscopes. Occasionally the contour of folds or of a tumor, or a gastro-enterostomy is seen. Usually the picture is hopelessly blurred and numerous highlights prevent a demonstration of the mucosal surface. Many artefacts appear and the trained

gastroscopist does not know whether he should laugh or become indignant at the diagnoses made according to these artefacts. Spots which, as the expert knows, are air bubbles or even just dust obscuring the optical system are described as "ulcers" and confirmed by operation. For instance, one may look up in the paper of Kohn (51) the pictures 2, 3, 4, 5, 6, 9, and 10 to become convinced that here we have to deal with just a toy, though an expensive one. The gastroscopist cannot draw sharply enough the line between this kind of science and gastroscopic research. Also the hopes I put on a development of the optical system have, in the gastrophotors, not been fulfilled. The pictures published by Garin and Bernay (33)—the best and most critical advocates of gastrophotography—are not much better than Bernay's pictures in 1931.

Anyhow, we need lasting documents. Today photography is not yet feasible through a flexible gastroscope. This is only a question of time. Light bright enough to illuminate the films must be found; films sensitive enough to record the finest nuances of color have to be invented. The old Henning camera already can be attached to the flexible gastroscope (Moutier, 61). Kirihara (49) has constructed a new photographic attachment. Neither yields satisfactory pictures as yet. Colored films will be tried which, however, will need still much more light.

After a highly satisfactory gastroscopic technique has been reached, after a new gastric pathology based on a comparison of the x-ray and gastroscopic findings has been developed, the next step will be to find a method which will enable us to record our findings permanently.

BIBLIOGRAPHY

1. Ansprenger, A., and Kirklin, B. R. Am. J. Roentgenol., 1937, 38: 533.
2. Ayala Gonzales, L. Gac. méd. de México, 1937, 67: 251.
3. Barnett, C. F. Al. Ass. Emory University School of Med., June 1, 1937.
4. Idem. South. Surgeon, 1937, 6: 502.
5. Benedict, E. B. New England J. M., 1934, 210:669.
6. Ibid., 1935, 212: 468.
7. Ibid., 1936, 214: 563.
8. Idem. Radiology, 1937, 28: 480.
9. Idem. Am. J. Digest Dis. & Nutrition, 1937, 4: 657.
10. Bertrand, J. Deux. Cong. de Gastro-Entérologie, p. 275.
11. Bonadies, A. Deux. Cong. de Gastro-Entérologie, p. 683.
12. Borland, J. L. Am. J. Digest. Dis. & Nutrition, 1936, 3: 744.
13. Idem. South. M. J., 1937, 30: 310.
14. Carey, J. B. Minnesota Med., 1936, 19: 652.
15. Idem. Surg., Gynec. & Obst., 1937, 65: 447.
16. Idem. Personal communication.
17. Catalanotti, V. Rassegna internaz. di clin. e terap., 1937, 18: 707.
18. Chevallier, P., and Moutier, F. Arch. de mal. de l'appar. digest., 1937, 27: 437.
19. Chevallier, P., Moutier, F., and Debray, C. Arch. de mal. de l'appar. digest., 1937, 27: 1042.
20. Chevallier, R. J. de méd. de Lyon, 1936, 17: 73.
21. Ibid., p 69.
22. Idem. Lyon méd., 1936, 158: 61.
23. Idem. Prat. de Lyon et de la Région, 1936, No. 4.
24. Idem. J. de méd. de Lyon, 1936, 17: 719.
25. Idem. Lyon méd., 1937, 159: 3.
26. Idem. Deux. Cong. de Gastro-Entérologie, p. 556.
27. Deuxième Congrès de la Société Internationale de Gastro-Entérologie, Bruxelles, 64 Rue de la Concorde, 1937.
28. Edwards, H. C. Brit. M. J., 1936, 1: 737.
29. Freeman, E. B. A. Rev. Gastroenterol., 1937, 4: 21.
30. Idem. Am. J. Digest. Dis. & Nutrition, 1937, 4: 312.
31. Idem. Deux. Cong. de Gastro-Entérologie, p. 636.
32. Gaither, E. H., and Borland, J. L. J. Am. M. Ass., 1938, 110:436.
33. Garin, C., and Bernay, P. Deux. Cong. de Gastro-Entérologie, p. 227.
34. Geier, F. A. Med. Ann. Dist. Col., 1937, 6: 161.
35. Gutzeit, K., and Teitge, H.: Die Gastroskopie. Berlin and Wien: Urban. u. Schwarzenberg, 1937.
36. Henning, N.: Lehrbuch der Gastroskopie. Leipzig: Barth, 1935.
37. Idem. Deux. Cong. de Gastro-Entérologie, p. 427.
38. Horan, J. Med. J. Australia, 1937, 24: 243.
39. Jackson, C., and Jackson, C. L. J. Am. M. Ass., 1933, 104: 271.
40. Idem: Bronchoscopy, Esophagoscopy and Gastroscopy. Philadelphia and London: Saunders, 1934.
41. Jones, C. M., Benedict, E. B., and Hampton, A. O. Am. J. M. Sc., 1935, 190: 596.
42. Jutras, A. Clinique, 1937, No. 280. p. 57.
43. Idem. Deux. Cong. de Gastro-Entérologie, p. 622.
44. Kapp, H. Second Internat. Kong. Gastro-Entérologie. Arch. f. Verdauungskr., 1937, 62: 280.
45. Idem. Deux. Cong. de Gastro-Entérologie, p. 592.
46. Katsch, G. Deux. Cong. de Gastro-Entérologie, p. 355.
47. Katsch, G., and Baltzer, F. Klin. Wchnschr., 1936, 15: 554.
48. Kerkhoff, A. C. Minnesota Med., 1937, 20: 666.
49. Kirihara, S., Nayakama, H., Satoh, Y., Konda, Y., and Ito, J. Nagoya J. Med. Sc., 1937, 2:1.
50. Kirklin, B. R. Radiology, 1937, 29: 492.
51. Kohn, L. W. Med. Rec., 1936, 144: 407.
52. Konjetzny, G. E. Deux. Cong. de Gastro-Entérologie, p. 517.
53. Lehmann, R.: Les atrophies gastriques dans les anémies idiopathiques et les métanémies. Paris: Le François, 1936.
54. Luehr, K. Klin. Wchnschr., 1936, 15: 1800.
55. Moersch, H. J. J.-Lancet, 1937, 68: 87.
56. Idem. Am. J. Digest. Dis. & Nutrition, 1936, 3: 15.
57. Morrison, T. H., Swalm, W. H., and Jackson, C. L. J. Am. M. Ass., 1937, 109: 108.
58. Moutier, F. Traité de Gastroscopie et de Pathologie Endoscopique de l'Estomac. Paris: Masson, 1935.
59. Idem. Arch. de mal. de l'appar. digest., 1937, 27: 659.
60. Ibid., p. 327.
61. Idem. Deux. Cong. de Gastro-Entérologie, p. 193.
62. Moutier, F., Girault, A., and Debray, C. Arch. de mal. de l'appar. digest., 1937, 27: 637.
63. Netousek, M. Deux. Cong. de Gastro-Entérologie, p. 680.

64. Okada, S., Terada, K., and Hotta, Y. Deux. Cong. de Gastro-Entérologie, p. 602.
65. Ortmayer, M. Illinois M. J., 1937, 71: 482.
66. Rafsky, H. A. Deux. Cong. de Gastro-Entérologie, p. 609.
67. Renshaw, J. F. J. Am. M. Ass., 1936, 107: 426.
68. Rigler, L. Radiology, 1937, 28: 372.
69. Rodgers, H. W.: Henning's Textbook of Gastroscopy. London: Oxford Press, 1937.
70. Idem. Lancet, 1936, 2: 438.
71. Rose, J. D. Newcastle M. J., 1937, 17: 51.
72. Rossi, C. Policlin., Rome, 1937, 44: sez. prat. 1207.
73. Royer, M., Bur, J. B., and Montejano, B. Semana méd., 1937, 44: 1487.
74. Schatzki, R. Radiology, 1937, 29: 488.
75. Schindler, R. Muenchen. med. Wchnschr., 1922, 69: 535.
76. Ibid., 1932, 79: 1268.
77. Idem. J. Am. M. Ass., 1935, 105: 352.
78. Idem. Am. J. Digest. Dis. & Nutrition, 1935, July.
79. Ibid., 1936, 3: 153.
80. Ibid., p. 751.
81. Idem. Surgery, 1937, 2: 692.
82. Idem: Gastroscopy: The Endoscopic Study of Gastric Pathology. Chicago: University of Chicago Press, 1937.
83. Schindler and Giere. Arch. Surg., 1937, 35: 712.
84. Schindler, R., and Ortmayer, M. Arch. Int. Med., 1936, 57: 959.
85. Schindler, R., Ortmayer, M., and Renshaw, J. F. J. Am. M. Ass., 1937, 108: 465.
86. Idem. Arch. Int. Med., 1937, 60: 143.
87. Schindler, R., and Renshaw, J. F. Am. J. Digest. Dis. & Nutrition, 1936, 3: 747.
88. Schindler, R., and Templeton, F. Radiology, 1937, 29: 472.
89. Schindler, R., and Wirts, E. Deux. Cong. de Gastro-Entérologie, p. 538.
90. Schloss, J. Internat. Clin., 1936, 4: ser. 46, p. 1.
91. Schloss, J., Ettinger, A., and Pratt, J. H. Am. J. M. Sc., 1937, 193: 171.
92. Staemmler. Deux. Cong. de Gastro-Entérologie, p. 641.
93. Stix, W. H. Journal of Medicine, Cincinnati, 1936, 17: 336.
94. Swalm, W. A., Jackson, C. L., and Morrison, L. Rev. Gastroenterol., 1936, 3: 219.
95. Taylor, H. Brit. J. Surg., 1937, 24: 469.
96. Templeton, F., and Schindler, R.: Roentgen and Gastroscopic Studies in Chronic Gastritis and Peptic Ulcer. Internat. Cong. Radiology, Chicago, 1937.
97. Thorlakson, P. H. T., and Stewart, C. B. Canadian M. Ass. J., 1937, 36: 345.
98. Tucker, G. Ann. Otol., Rhinol. and Laryngol., 1936, 45: 1179.
99. Uhlenbruck, P., and Norpoth, L. Arch. f. Verdauungskr., 1937, 62: 241.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Fallis, L. S.: Direct Inguinal Hernia. *Ann. Surg.*, 1938, 107: 572.

The author believes that the poor results of operation for the repair of direct inguinal hernia are directly attributable to the employment of methods which are satisfactory for indirect hernia, but unsuitable for the direct variety because of the different problems involved. He finds that next to the umbilicus, Hesselbach's triangle is the weakest point of the abdominal parietes. This area receives support from the peritoneum and properitoneal fat posteriorly, and from the conjoined tendon anteriorly. The author finds that in many cases a large external inguinal ring precedes the formation of a direct inguinal hernia. There are, however, several anatomical variations in these patients which would lend weight to the theory that the direct hernia is congenital, or at least that there is a congenital predisposition to it. The aponeurosis of the external oblique muscle is usually intact, but the rectus muscle is much narrower than normal; the fleshy fibers of the internal oblique and transversal muscles arch upward to unite at the edge of the rectus muscle and enter its sheath, and the conjoined tendon is either rudimentary or absent. Thus the integrity of the transversal fascia constitutes the only barrier against the formation of the hernia.

The author believes that the diagnosis of the type of hernia, direct or indirect, can often be made clinically by the palpation of the floor of Hesselbach's triangle through the subcutaneous inguinal ring. The incidence of direct hernia has increased from 15.7 to 25 per cent in the last decade, which the author attributes to the more rigid pre-employment examinations which are now being performed.

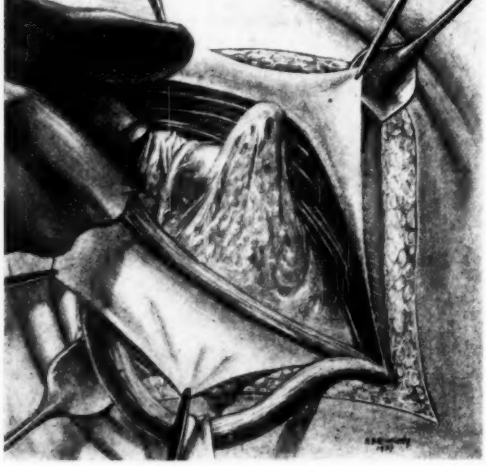
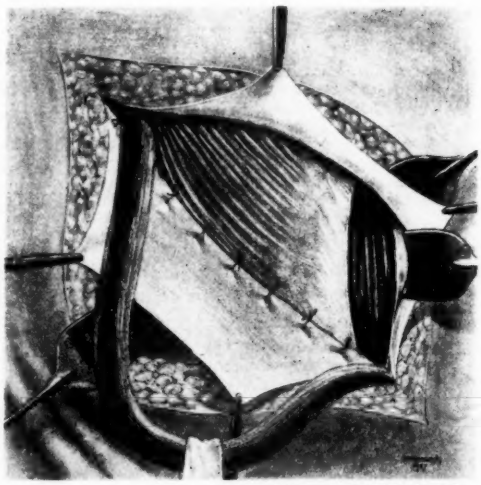


Fig. 1.



Courtesy of J. B. Lippincott Co.

Fig. 2.

The repair of the direct hernia is a plastic procedure, which must be directed toward the utilization of all available tissue to the best advantage and the avoidance of suture under tension. The author exposes the spermatic cord, and opens the cremasteric muscle. He then opens the sac in the manner described by Hoguet. This is accomplished through location of the small potential indirect sac which is constantly present in intimate relation to the vas. This sac is opened and the finger inserted into the peritoneal cavity and out through the sac of the direct hernia (Fig. 1). Traction is now put on the indirect sac by the brushing away of the properitoneal fat, which brings into view first the deep epigastric vessels and then the obliterated hypogastric artery, until the bladder appears in the wound. It will now be found that the entire direct sac lies lateral to the deep epigastric vessels and can be ligated. The rectus muscle is sharply retracted medially, to pick up the intact portion of the transversal fascia, which is sutured to Poupart's ligament. The author then dissects the aponeurosis of the external oblique muscle free from the rectus sheath, which, he states, can readily be done as it is inserted to the linea alba. An incision is now made in the rectus sheath in a vertical direction, upward from the pubis, for two or three inches. This permits the approximation of the firm

fibrous lateral edge of the rectus sheath to Poupart's ligament without tension. The aponeurosis is now imbricated under the spermatic cord, and serves to cover the rent in the rectus sheath (Fig. 2).

The author has been able to follow up 154 of 251 patients who were operated upon for direct hernia for a minimum period of two years. Among these there had been 18 recurrences (11.6 per cent).

WILLIAM C. BECK, M.D.

Klein, W.: Non-Specific Mesenteric Adenitis: A Report of 140 Cases. *Arch. Surg.*, 1938, 36: 571.

The anatomy of the mesentery of the small intestine is reviewed. The mesentery of the terminal portion of the ileum differs in important details from that of the rest of the intestine. The last 6 cm. of the mesentery of the ileum is free from glands, its fibers converge from left to right, and no vessels traverse this space. It is often called the avascular space of Treves. The lymphatic drainage of the intestines is accomplished by means of two sets of vessels, one originating in the mucosa and submucosa, and the other in the muscularis and subserosa.

The author performed experiments on living subjects in the course of laparotomies on both animals and human beings. A 1 per cent solution of indigo carmine was injected into the subserosa of the ileum and the distribution of the dye in the lymphatic channels was observed. The drainage from the lowermost part of the ileum (corresponding to the avascular space of Treves) was from left to right. The lymphatics ran to the satellite nodes of the ileocecal artery.

The lymphatics of the appendix are not independent of those of the cecum. The latter has two sets of lymphatics, one set emerging from the anterior wall and another set emerging from the posterior surfaces. Both run toward the ileocecal chain directly or through the intermediary of the anterior and posterior cecal glands. A number of lymphatic glands are found in the ileocecal angle that drain the appendix, the cecum, and the lowermost small segment of the ileum. These drain along the mesenteric artery, emptying into the chain near the third portion of the duodenum.

The pain of mesenteric adenitis is not easily explained. A possible explanation is that inflammation and hyperplasia of the glands cause pressure on the sensory pacinian capsules in the mesenteric leaves, or perhaps these sensory organs are directly invaded by toxins.

The cause of mesenteric adenitis is absorption of toxins from the intestinal tract. These toxins may be of bacterial origin or may be the products of digestion. The statement that mesenteric adenitis is preceded by an infection of the upper respiratory tract is not borne out by careful histories and close observation, and is also contrary to the normal physiology of the animal body. The fact that mesenteric adenitis is always accompanied or immediately preceded by inflammation of the intestines, as observed at operation, is further evidence that this form of adenitis is a direct result of pathological conditions in the intestines. There is, however, a small group of cases of very acute involvement in which infection of the upper respiratory tract occurs simultaneously with mesenteric adenitis. In these cases it is perhaps a general toxemia that brings the toxins to the intestines via the blood stream and causes inflammation with consequent glandular hypertrophy. In only 8 per cent of the author's series was there a history of a preceding upper respiratory infection.

The author classifies non-specific mesenteric adenitis into three types according to the symptomatology, which he describes in detail. The first group is the least common, and occurs in children from six to twelve years of age. The onset is sudden with high fever, marked toxemia, and a high blood count. The face is flushed, the pulse rapid, and the throat congested and inflamed. The abdomen is distended and tender throughout, especially in the right lower quadrant. When operated on, the whole intestinal tract, particularly the small intestines, is thickened and extremely red, and the mesenteric glands are deep pink. The second type is most common and is often mistaken for appendicitis. However, the tender point in the right lower quadrant is at a higher level than in appendicitis and is internal to McBurney's area; and when the patient is turned on the left side, the tender area is shifted to the left and is absent on the right. This one sign, when present, has always differentiated mesenteric adenitis from acute appendicitis. The third type of mesenteric adenitis described by the author gives the same history as the second, but examination of the abdomen discloses that whereas the tenderness can be shifted from right to left with change of position, tenderness over the cecum persists. This type cannot always be differentiated from a pathological process which involves the appendix. The operative findings in the second and third groups are also described in detail.

The author concludes that:

1. Mesenteric adenitis is much more common than is generally recognized.
2. A diagnosis is possible in a majority of cases.
3. Mesenteric adenitis is not necessarily an accompaniment of an infection of the upper respiratory tract.

JOHN H. GARLOCK, M.D.

GASTRO-INTESTINAL TRACT

Walters, W.: Chronic Gastric Ulcer. *Am. J. Surg.*, 1938, 39: 62.

The similarity of the syndromes associated with benign gastric ulcer and with benign duodenal ulcer has led to the thought that they are lesions of similar type. They differ, however, not only from the standpoint of the type of tissue in which the ulceration occurs, but also from that of the variable pathological nature of the lesions themselves, and from that of their response to both medical and surgical treatment.

Of first importance, when a patient presents himself with a history suggesting benign ulceration of the stomach or duodenum, is that roentgenological examination be made by a competent roentgenologist to determine the exact situation of the lesion. If the lesion can be proved by roentgenological examination to be in the duodenum, and if a medical regimen is chosen for treatment, the possibility of the duodenal lesion's being or becoming malignant is practically non-existent. In dealing with gastric ulcers at the Mayo Clinic, the author proceeds on the assumption that chronic ulcerating gastric lesions are malignant until they are proved to be benign.

The treatment of gastric ulcer is dependent on several factors, among which are: (1) the duration and type of symptoms; (2) the healing of the lesion, or its failure to heal under a medical regimen carried out in a scientific fashion; (3) the presence or absence of a crater, especially with respect to bleeding; and (4) the presence or absence of pyloric obstruction.

When the symptoms have been of short duration and the ulcer is small, every attempt should be made to induce healing of the lesion by non-surgical means. When roentgenological examination discloses that the ulcer has a demonstrable crater, especially when episodes of bleeding have occurred, when the lesion is producing pyloric obstruction, or when it is prepyloric in situation or is on the greater curvature, generally speaking, surgical removal of the lesion should be undertaken without delay. The fact that an ulcer of the stomach is reported by the roentgenologist to be probably benign, does not exclude the possibility that the lesion is carcinomatous. The roentgenologist wishes such an opinion of his to be considered only as a contribution to the final diagnosis.

In our experience at the clinic, each year a considerable percentage of patients operated on for carcinoma of the stomach have related, in their early histories, symptoms indistinguishable from those of benign ulceration.

The types of operation available in the treatment of gastric ulcer consist of: (1) partial gastrectomy followed by anastomosis of the stomach and duodenum (Billroth I), or of the stomach and jejunum (Polya-Balfour); (2) excision of a portion of the stomach containing the gastric ulcer, or destruction by cautery of the gastric ulcer, in some cases combined, and in other cases not combined, with gastro-enterostomy; (3) transgastric excision of the ulcer from the posterior wall of the stomach; and (4) sleeve resection of the stomach.

The type of operation to be selected for each case is dependent on the type of lesion; its size, situation, and accessibility; the amount of deformity of the stomach that would result from its removal; and the general condition of the patient. In selection of the type of operation most suited to the patient or the lesion, the following general statement seems justified: partial gastrectomy, particularly for large gastric ulcers, with either a Billroth I, or a Polya, or a Polya-Balfour type of anastomosis, is the preferable procedure, provided it can be performed with a mortality as low as 3 or 4 per cent. The reasons for this are: (1) the prompt relief of symptoms, (2) the almost total absence of recurring ulceration, and (3) the fact that partial gastrectomy is the preferable procedure should the lesion prove to be malignant.

There is a place for destruction of the ulcer by cautery, or for segmental resection of a portion of the stomach containing the ulcer, either operation combined with gastro-enterostomy. Whereas, in the author's experience the mortality of partial gastrectomy for large gastric ulcers has been approximately from 3 to 4 per cent, destruction by cautery, or excision of a gastric ulcer, combined with gastro-enterostomy, usually can be performed with a mortality not greater than that of gastro-enterostomy. The working principle can be accepted that excision or destruction of small gastric ulcers by cautery, combined with gastro-enterostomy, is a suitable operation of low risk, and partial gastrectomy, an operation of greater risk, can be reserved for the large, penetrating, frequently hemorrhagic, gastric ulcer.

During 1936, partial gastrectomy for benign and malignant lesions of the stomach and duodenum was performed in 213 cases. Of these operations, 104 were for benign lesions, with a mortality of 3.8 per cent. In 33 cases the operation was a primary partial gastrectomy performed for gastric ulcer. An additional 5 patients had undergone gastro-enterostomy previously; in these 5 cases, therefore, in addition to partial gastrectomy, removal of the gastro-enterostomy and closure of the jejunal opening was carried out.

In the cases of 25 patients in whom gastric ulcers were removed by local excision, combined with gastro-enterostomy or destruction by cautery, no deaths occurred. On only 2 occasions in the last three years has the author been satisfied to perform segmental resection of a portion of the stomach containing the ulcer without also performing gastro-enterostomy. Excision of the ulcer and sleeve resection of the stomach were employed infrequently.

On the basis of roentgenological examination, gastric ulcers situated high on the lesser curvature and situated high on the posterior wall of the stomach are frequently reported to be of questionable accessibility to surgical removal. Their high situation is likely to be considered an additional reason for continuation of the medical treatment which has failed to cause healing of the ulcer previously. The fact that all benign gastric lesions are accessible to surgical treatment deserves emphasis.

The results of a properly chosen, properly performed operation for gastric ulcer are some of the best in surgery, and recurrence of the ulcer, or disturbing symptoms without formation of an ulcer are practically never encountered. This is true especially when the operation performed is partial gastrectomy.

Rife, C. S.: Gastrojejunocolic Fistula. *Am. J. Surg.*, 1938, 39: 73.

This report is based upon 14 cases of gastrojejunocolic fistula. The original lesion was a duodenal ulcer in 13 of these patients. An extensive carcinoma of the stomach extending into the transverse colon was the primary causative lesion in the fourteenth case.

Hyperacidity was believed to play a major rôle in the production of not only peptic ulcer but also jejunal ulcer. Rife, however, notes that although duodenal ulcers are more likely to be associated with higher acids than gastric ulcers, and gastrojejunal ulcer and fistula are much more common following operations for duodenal ulcer, "all the blame for these complications cannot be attributed to hyperacidity for duodenal ulcers are much more common than gastric ulcers. Gastrojejunal ulcer and fistula are practically unheard of in patients in whom the gastroenterostomy was done for unresectable carcinoma of the stomach." This fact is probably explained by the anacidity or very low acidity present in carcinoma of the stomach. Tight intestinal clamps cannot be held as a causative factor because the jejunal ulcer usually occurs in that portion of the jejunum not gripped by the clamps and the interval between operation and the onset of ulcer symptoms may be several years.

The work of Hurst and Stewart is presented as contributory evidence supporting this theory on etiology. These investigators performed autopsies on 141 patients who had had operations for ulcer. In this group there were 46 patients who had died within ten years postoperatively and none of these showed evidence of jejunal ulcer at autopsy. In another group of 43 patients whose deaths occurred nine or more months postoperatively, there were 22 cases of jejunal ulcer.

Non-absorbable suture material has also been held responsible for the production of anastomotic ulcers, but this theory has been largely abandoned. The complication is still highly prevalent in spite of the use of absorbable material.

Fistula, of course, practically always is a complication of posterior rather than anterior gastroenterostomy. The inflammatory process in the jejunum extends well down into the root of the mesentery near the ligament of Treitz, making resection of the fistula very difficult. In the majority of cases the fistulous tract connects the jejunum and the transverse colon. A direct connection between the stomach and colon is uncommon. Ulceration of the tract itself is unusual and there may be no active marginal ulcer, especially in those cases in which the communication between the jejunum and colon is located quite distal to the gastro-enterostomy stoma. The fistulas are nearly always single, usually from 4 to 6 cm. long. The efferent loop of jejunum is usually dilated and hypertrophied. The colon may be constricted at the site of the fistula and dilated approximately to this point, simulating intestinal obstruction.

The symptomatology usually consists of a diarrhea of watery or semiliquid stools containing liquid fats which are usually very foul-smelling. Vomiting may occur but fecal vomiting is unusual. Foul-smelling eructations are, however, fairly characteristic. The type of pain is not characteristic. Anorexia and loss of weight are usually present.

The diagnosis can be made by careful roentgenological study and "if barium is present in the colon shortly after leaving the stomach, the diagnosis of gastrocolic or gastrojejunocolic fistula may be postulated with certainty." If a fistula is suspected it may be confirmed by a barium enema.

The treatment is surgical and varies from simple closure of a fistula with restoration of the normal gastro-intestinal continuity to extensive "en bloc" resection in which the involved loop of jejunum, part of the colon, and the pyloric antrum are resected. Early operation is indicated but the importance of adequate pre-operative preparation of the patients with gastrojejunocolic fistula cannot be overemphasized. There usually is a marked loss of body weight with noticeable alteration in the body chemistry. Dehydration, acidosis, alkalosis, hyperchlorosis, ketosis, and avitaminosis may all be present and should be restored as nearly to normal as possible before the operation is attempted.

SAMUEL J. FOGELSON, M.D.

Cace, M.: Primary Tumors of the Duodenojejunal Tract. Lymphogranuloma of the Duodenum (Tumori primitivi del tratto duodeno-digiunale. Linfogranuloma del duodeno). *Radiol. med.*, 1938 25: 365.

Cace states that among the various malignant tumors of the gastro-intestinal tract, those of the duodenum are exceedingly rare. In a series of 500,000 autopsies an incidence of only 0.3 per cent has been reported. Malignant neoplasms of the jejunum, however, are less rare, their incidence being about 1 per cent. It is not surprising that the diagnosis of malignancy of the duodenum is exceedingly difficult in the live patient.

The first roentgenological reports of these lesions were incomplete and inadequate. The author had the opportunity in 1933 and 1934 to observe 6 patients presenting malignant lesions of the upper intestinal tract. These lesions were all localized below the insertion of the mesocolon and above the ileum; four of the tumors were localized at the second portion of the duodenum, 1 was localized at the papilla of Vater, and 1 was found to involve the first loops of the jejunum. Five of the tumors were carcinomas and the sixth represented an inflammatory hyperplastic process of probable lymphogranulomatous character.

On the basis of clinical and roentgenological studies of these cases, Cace concludes that primary malignant tumors of the duodenum may cause a more or less extensive stenosis. The mucosal outline is lost, the elasticity is decreased, and peristalsis is abolished. The stenosis is accompanied by a tume-

faction of this portion of the intestine which in turn gives rise to pressure effects upon the duodenum and the antral portion of the stomach, without causing, however, alterations of the pyloric outline and the duodenal cap. Important diagnostic signs in this respect are the absence of perivisceritis of the adjacent organs, and a well delimited area of stenosis with the reappearance of the mucosal outline just beyond that portion of the duodenum which has not been invaded by the neoplastic process.

The aforementioned stenosis may be accompanied by the appearance of more or less extensive filling defects and in this case the intestinal wall presented an irregular or circinate contour. In some cases there may be roentgenological evidence of small or large ulcers presenting ragged borders. Duodenobiliary fistulas have also been visualized in these conditions.

According to the author, tumors originating at the papilla of Vater are characterized by their "flame-like" appearance. This finding is of greatest importance in the diagnosis of a malignancy involving the papilla of Vater.

Concerning the roentgenological evidence of malignant tumors of the jejunum, the author's findings conform fully with those exposed by Possati, who first described these lesions roentgenologically.

RICHARD E. SOMMA, M.D.

Bower, J. O.: The Lucid Interval and Acute Appendicitis. *Am. J. M. Sc.*, 1938, 195: 529.

In reviewing the results obtained during the past four years in the management of patients suffering from acute appendicitis complicated by spreading peritonitis, the author found that in every instance where death occurred the surgeon did not diagnose the condition pre-operatively. The most frequent error was the failure to recognize early perforative peritonitis. The second most frequent error was inability to diagnose the gangrenous appendix in the preperforative state. Examination of clinical records too often has shown that the patient gave a typical history of appendiceal colic and that the physician, finding tenderness in the lower right quadrant, made the diagnosis of appendicitis; but before admission of the patient to the hospital all signs and symptoms had disappeared, except for a moderate elevation of temperature. Without exception, the lesion responsible for this "lucid interval" was partial or complete appendiceal gangrene.

The "lucid interval," as used in connection with gangrenous appendicitis, is the symptom-free period preceding perforation, and is dependent upon factors which influence intra-appendiceal pressure. The subsidence of pain, remission of temperature, the absence of tenderness, and the increased tension or rigidity are due in part to a reduction of intra-appendiceal pressure. The symptoms and signs accompanying an acutely inflamed appendix, prior to the development of gangrene, are associated with and partially dependent upon increased intra-appendiceal pressure.

The diagnosis of the preperforative stage of acute appendicitis is dependent upon the following:

1. A complete history.
2. A thorough physical examination.
3. The physical findings in the patient of the physician who first examined him, which should be noted on the clinical record.
4. A careful differential blood count with observations on the ratio of mature to immature neutrophils, and also the relative number of degenerated immature forms.

In defense of the family physician, it must be admitted that in many instances, either because of the influence of relatives or friends, patients refuse to accept his advice. To protect himself, consultation with a surgeon should be advised. Every physician no doubt has had the experience of permitting the wishes of a patient to interfere with what he thinks should be done. Most patients will consent to operation, but there are a few who doubt its necessity and are anxious to avoid it. These reluctant patients usually give an accurate history, but will not admit that abdominal tenderness and pain is present on palpation.

In conclusion, the author states that the high mortality of spreading peritonitis complicating acute perforative appendicitis (from 27 to 40 per cent in the United States), is in part due to the failure of physicians and surgeons to diagnose accurately the acute lesions of the appendix in both preperforative and early postperforative states. Partial or complete gangrene of the appendix is frequently associated with a subsidence of symptoms and an absence of physical signs. This is a so-called "lucid interval," and is often confused with the resolution following an acute involvement of the appendix, of less virulent character. The subsidence of symptoms and signs accompanying both is due to diminished intra-appendiceal pressure: this is caused by the relaxation incident to devitalization of the serosa in the first instance, and by the absorption of the products of inflammation in the latter.

In this article, the author has endeavored to emphasize pertinent points which may aid in the recognition of this "lucid interval."

JOHN W. NUZUM, M.D.

Altemeier, W. A.: The Bacterial Flora of Acute Perforated Appendicitis with Peritonitis. *Ann. Surg.*, 1938, 107: 517.

The author reports the study of the bacterial flora, both aerobic and anaerobic, of the purulent peritoneal exudates secondary to acute perforated appendicitis.

The cases included in this study were those of local peritonitis, general or diffuse peritonitis, and abscess. Sixteen different species of aerobic microorganisms were isolated from the peritoneal exudate. Only one negative aerobic culture was obtained. Bacillus coli has been repeatedly reported and was recovered most frequently. It was found alone or in association with other bacteria in 79 per cent of

the cases. Some form of streptococcus was present in approximately 44 per cent of the cases. A pure culture of one aerobic organism was obtained in 24 instances. The most frequent combination of aerobes was bacillus coli and a non-hemolytic streptococcus.

Anaerobic micro-organisms were cultivated in 96 of the 100 cases of peritonitis studied. At least 18 different species of anaerobic bacteria were recovered from the purulent exudates. It is of especial significance to note the fact that bacillus melanogenicum was cultured from the peritonitis exudate of 89 cases, or 92.7 per cent of the total number of cases yielding positive anaerobic cultures. As far as the writer has been able to determine, this bacterium has never been described before in the purulent peritoneal exudate secondary to acute perforated appendicitis.

In a comparison of the flora in the fatal and non-fatal cases, little difference is found in the type of species present. The bacillus coli, bacillus melanogenicum, and anaerobic streptococcus were recovered from each of the 6 fatal cases. Comparing the flora of the original peritoneal exudate with that of its secondary and metastatic abscess complications, the writer found essentially the same organisms in each instance.

It is not surprising that the bacterial flora found in the peritoneal exudate resulting from a perforated appendix is so complex and varied. Any perforated lesion in the region of the appendix or cecum necessarily results in contamination of the peritoneal cavity by a large number and variety of organisms resident in the intestine at the time of perforation. Many of these bacteria grow prolifically in the peritoneal cavity. When cultured outside the body, they grow best in close association or symbiosis with each other. It may be said that the bacterial flora of these patients presented a very complicated and bizarre picture, contrary to the generally accepted idea that bacillus coli and the streptococcus are the chief causative agents of appendicitis with peritonitis.

JOHN W. NUZUM, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Ochsner, A., DeBakey, M., and Murray, S.: Pyogenic Abscess of the Liver. II. An Analysis of 47 Cases, with a Review of the Literature. *Am. J. Surg.*, 1938, 39: 292.

During the ten-year period from 1928 to 1937, inclusive, 186 patients with abscess of the liver were admitted to the Charity Hospital and the Touro Infirmary in New Orleans. Of this number, 139 (74.7 per cent) presented amebic abscesses and 47 (25.2 per cent) pyogenic. This report is based upon an analysis of the latter, and 830 cases of pyogenic hepatic abscesses collected from the world literature.

The sex incidence of pyogenic hepatic abscess reveals a preponderance of occurrence in the male and this is probably explained by the fact that the etiological agents occur more frequently in the male. In a collected series of 830 cases of liver abscess, there were 560 (67.4 per cent) males and 270 (32.5 per cent) females. In the authors' series of 47 cases there were 33 (70.2 per cent) males and 14 (29.7 per cent) females. The greatest age incidence is from the third to the fifth decade. No significant racial predisposition was found.

Pyogenic hepatic abscesses are the result of invasion by pyogenic micro-organisms and can occur in the following ways:

I. Transportation of virulent micro-organisms through the portal vein from areas drained by the portal system
   A. Appendix
   B. Rectum
   C. Other portions of the bowel
II. Extension from contiguous diseased processes
   A. Cholecystitis and cholangitis
   B. Gastric and duodenal ulceration
   C. Subphrenic space infection
III. Trauma
   A. Penetrating injuries with the introduction of micro-organisms from without.
   B. Subcutaneous injuries producing devitalization of liver tissue and permitting growth of micro-organisms already present in the liver.
IV. Blood-borne infections with the production of metastatic abscesses, the micro-organisms being transported through the hepatic arteries.

Undoubtedly, one of the most frequent antecedent lesions in pyogenic abscess of the liver is suppurative appendicitis which is complicated by portal thrombophlebitis (pylephlebitis). Whereas, in a collected series of 575 cases, there were 197 (34.2 per cent) cases in which appendicitis was the etiological agent, in the authors' series of 47 cases appendicitis was the exciting lesion in only 5 (10.6 per cent). This discrepancy is accounted for by the fact that the majority of the reports in the literature represented primarily the authors' interest in pylephlebitis and liver abscess as complications of appendicitis. This is corroborated by the fact that in those series of cases which include pyogenic liver abscess due to all causes, the incidence of appendicitis more nearly approximates that in the authors' cases. The incidence of portal thrombophlebitis and liver abscess following appendicitis varies from a little more than 1 per cent to less than 0.1 per cent. In a collected series of 68,198 cases of appendicitis, there were 247 cases with these complications, an incidence of 0.36 per cent. In the authors' series of 5,293 cases of acute appendicitis during the ten-year period, there were 5 cases complicated by liver abscess, an incidence of 0.094 per cent. Pyogenic liver abscess can be caused by lesions in the portal area other than appendicitis. Such lesions include gastro-intestinal ulceration, diseases of the rectum, spleen, and the pancreas. In the collected series of 575 cases, these formed 10.2 per cent of all causes, and in the authors' series, 8.4 per cent. Cholecystitis was found to be the cause in 14 per cent of the

collected cases and in 6.3 per cent of the authors'. Trauma was the etiological agent in 2.9 per cent of the collected cases and in 10.6 per cent of the authors'.

There is a relatively large group of pyogenic hepatic abscesses in which the antecedent lesion cannot be determined, and which for this reason have been termed "cryptogenic," idiopathic, or primary pyogenic liver abscesses. Whereas in the collected series of 575 cases this group constitutes 17 per cent, in the authors' series of 47 cases it represents the largest number, 59.5 per cent. It has been suggested that such abscesses are the result of hematogenous infection due to distant foci which may be so inconspicuous as to be completely overlooked, or, that in most of these cases the micro-organisms are transported through the portal vein and the antecedent lesions in the portal area are of such minor character that they are not recognized clinically.

The organisms most frequently found in pyogenic hepatic abscesses are the bacillus coli, the streptococcus, the staphylococcus, or a combination of these. In a collected series of 184 cases, the bacillus coli was found to be the causal agent in 30.4 per cent, the streptococcus in 26.6 per cent, the staphylococcus in 26 per cent, and a combination of these in 13.5 per cent. In the authors' series of 29 cases which were studied bacteriologically, these incidences were 31, 20.6, 17.2, and 17.2 per cent respectively.

The pathological characteristics of pyogenic hepatic abscess consist usually of an enlargement of the liver, a perihepatitis due to involvement of Glisson's capsule, and multiple abscesses scattered throughout the liver substance or, in some cases, more or less confined to particular sections, the left lobe escaping involvement more often than the right. These necrotic areas may vary in size from a fraction of a millimeter in diameter to a centimeter or more. By coalescence, small abscesses form larger cavities, or, in some cases, adjacent necrotic areas impart a honeycomb appearance to the diseased organ. Cellular necrosis characterizes the areas of abscess formation, the central portions of larger lesions containing practically nothing but cellular detritus, while a fibrous capsule bounds the periphery. Microscopically in pylephlebitis, round-cell infiltration of the venous wall is seen and leucocytes and cellular detritus are present in the lumen. Adjacent liver cells exhibit reaction to the inflammatory process, with various stages of degeneration usually being demonstrable.

Whereas in the collected series of pyogenic hepatic abscess only 28.8 per cent were single, in the authors' series 54.5 per cent were single. In the collected cases the right lobe alone was involved in 41.8 per cent, the left lobe in 4.8 per cent, and both lobes in 53.2 per cent. In the authors' series these incidences were 68.1, 2.2, and 27.2 per cent, respectively. Whereas in the collected cases 71.1 per cent were multiple, in the authors' series only 45.4 per cent were multiple. This discrepancy is probably due to the considerably greater incidence of appendicitis in the collected cases.

The clinical manifestations of pyogenic hepatic abscess may be divided into two groups, systemic and local. The most frequently encountered systemic manifestations are fever, pain, chills, and profuse sweating Less frequently, malaise, anorexia, loss of weight, weakness, nausea, and vomiting occur. In the classical multiple liver abscess associated with pylephlebitis and suppurative appendicitis, fever is characteristically of the picket-fence type and is usually accompanied by daily chills. Of the local manifestations, tenderness in the hepatic area and liver enlargement are the most constant. In a series of 286 collected cases, fever, pain, tenderness, and liver enlargement were present in 95.8, 92, and 89.3 per cent, respectively. In the authors' cases, these incidences were 93.6, 91.4, and 61.7 per cent. Characteristically, there is a leucocytosis with a proportionate increase in polymorphonuclear leucocytes. This is in contrast to the findings in amebic hepatic abscess in which there is a moderate increase in leucocytes. In the authors' series, the average leucocyte count in the acute cases was found to be 26,924, whereas in the chronic cases it was 14,077. In the chronic cases of pyogenic hepatic abscess there is usually an associated secondary anemia. The characteristic roentgenological changes are elevation and immobility of the diaphragm, usually on the right side. The diagnosis was positive in 82.1 per cent of 28 cases in the authors' series in which roentgenological studies were made.

Aside from the virulence of the organism and the resistance of the host, the prognosis in pyogenic hepatic abscess depends upon: (1) the multiplicity of the lesions and whether there is an associated pylephlebitis, (2) the presence or absence of complications, and (3) the type of drainage instituted. Nine (37.5 per cent) of the 24 patients in the authors' series with single abscess of the liver and 19 (95 per cent) of the 20 patients with multiple abscesses died. The significance of the presence of complications in pyogenic hepatic abscess is demonstrated by the fact that in a collected series of 97 cases of pyogenic liver abscess with complications, the mortality rate was 90.7 per cent, in contrast to a mortality rate of 60.8 per cent in a similar series of 161 cases without complications. The mortality rate in the authors' series was 90.9 per cent in 22 cases with complications, and 36 per cent in 25 cases without complications. The importance of the type of therapy employed in pyogenic abscess of the liver is emphasized by the results obtained in the collected and in the authors' series of cases. The total mortality rate in a collected series of 432 cases was 79.6 per cent. The total mortality rate in the authors' series of 47 cases was 72.3 per cent. In a collected series of 102 cases not operated upon the mortality rate was 100 per cent, while in a collected series of 151 cases in which operation was performed,

the mortality rate was 50.9 per cent. These respective mortality rates in the authors' series were 100 per cent and 64.8 per cent. In 22 of the authors' cases in which the transabdominal approach was employed for the institution of drainage there were 16 deaths (72.7 per cent). The transpleural method of drainage was used in 9 cases with 6 deaths (66.6 per cent). In contrast to these high mortality rates is the 33.3 per cent mortality obtained in 6 cases in which the extraserous approach was used for the institution of drainage.

The complications of pyogenic hepatic abscess are usually the result of rupture or direct extension of the abscess into one of the adjacent viscera, or, more rarely, of thrombosis and embolism. In a collected series of 453 cases, including those of the authors', pleuropulmonary complications occurred in 69, an incidence of 15.2 per cent. In the authors' series of 47 cases there was an associated pneumonia in 5 (10.6 per cent), lung abscess in 4 (8.5 per cent), and empyema in 2 (4.2 per cent). Peritonitis as a complication of pyogenic liver abscess is a result either of rupture of the abscess into the peritoneal cavity or of contamination by transperitoneal drainage of the abscess. In a collected series of 453 cases, including those of the authors, peritonitis was found in 33, an incidence of 7.2 per cent. Subphrenic abscess as a complication of liver abscess occurs relatively infrequently. In the 453 collected cases, including those of the authors, this complication was present in 18 (3.9 per cent). Liver abscess associated with generalized pyemia is likely to be complicated by abscesses of other organs. These complications were found to have occurred in 18 (3.9 per cent) of 406 collected cases.

The treatment of pyogenic hepatic abscess may be divided into: (1) prophylactic, and (2) surgical. Prophylaxis is applicable particularly to multiple hepatic abscesses which are preceded by appendicitis and pylephlebitis, because once the development has proceeded to the stage of multiple abscess formation, surgical therapy offers only the slightest hope. It is essential that the appendiceal, ileocolic, superior mesenteric vessels, and even the portal veins be examined carefully during the operation in cases of appendicitis which give a history of chills occurring pre-operatively. Such an examination will permit the recognition of thrombosis in these vessels, the degree of its extension, and, by the application of proper surgical therapy, the prevention of the possible development of pylephlebitis and multiple liver abscess. Once pylephlebitis has occurred and is recognized either pre-operatively or post-operatively, the treatment is surgical. The treatment of solitary pyogenic hepatic abscess consists of incision and drainage. The type of drainage instituted is extremely important, as has been mentioned above. Only that type of drainage which completely avoids the slightest possibility of contamination of a virgin pleural or peritoneal surface should be employed. Depending upon the location, this can be readily accomplished by an extraserous anterior or posterior approach. If there is evidence of location of the abscess in the anterior or anteroinferior surface of the liver, the procedure advocated by Clairmont for drainage of subphrenic abscess can be utilized. If there is no evidence of localization of the abscess in the anterior abdominal region, the most rational method of drainage is by the retroperitoneal approach previously described by Nather and Ochsner. This procedure consists, briefly, of making the skin incision directly over the twelfth rib and, after subperiosteally resecting this rib, making a transverse incision through its bed at the level of the spinous process of the first lumbar vertebra. After entrance through this incision into the retroperitoneal space between the upper pole of the kidney and the inferior surface of the liver, mobilization of the parietal peritoneum from the under surface of the diaphragm can be readily effected. The results obtained in those cases in the authors' series in which this method of drainage was instituted clearly demonstrate its advantages.

Smith, M. K.: The Treatment of Acute Cholecystitis. *Am. J. Surg.*, 1938, 39: 192.

In recent years there has been a swing in surgical opinion toward earlier intervention in acute cholecystitis.

Five years ago, in an endeavor to clarify his ideas on the subject, the writer analyzed a series of 201 patients who came to operation for this condition at St. Luke's Hospital, New York. The mortality of the series was 7.3 per cent. Dividing them into two groups on the basis of whether the disease was still active or had subsided at the time of operation, the author found that the mortality of the former group was 9.3 per cent and of the latter 5.3 per cent. Recently these histories have been reviewed; private and unoperated cases, as well as some previously overlooked, included; and the series brought up to date, the total amounting to 436 cases over a seventeen-year period. Of these patients, 356 were operated upon with a mortality of 8.4 per cent. Of the 80 patients who were not operated upon 6.3 per cent died.

The incidence of empyema, gangrene, and perforation increases as the attacks are prolonged. In the St. Luke's Hospital series 27 per cent of these conditions developed in the first week, 31 per cent in the second week, and thereafter 53 per cent. To avoid these more serious pathological conditions is one of the purposes of early intervention.

There is a general impression that an attack of acute cholecystitis, if treated expectantly, will subside in the large majority of cases. Zinninger, however, in observing 54 patients for periods of from twenty-four hours to twelve days, found that less than two-fifths showed improvement in their condition while the remainder showed no improvement or their condition became worse.

The nub of the question of when to operate is that of the risk of immediate surgery versus the risk of delay.

Heuer, Graham, McKenty, and Mentzer advocate early operation and show a lower mortality rate in these cases.

Miller, stimulated by the occurrence of perforation in 2 cases in which operation was being delayed, studied the material at the Massachusetts General Hospital, Boston, and found that in the fatal cases the average duration from the onset of the attack to operation was fifteen days while in those with recovery the average time was eight days. He felt that the expectant plan of treatment should be promptly abandoned if the patient was not definitely improving.

Branch and Zollinger reviewed the material at the Peter Bent Brigham Hospital, Boston, in an article which they designated as a study of conservative treatment. Thirty-four of their series of 229 operative cases were submitted to immediate surgery with a mortality of 14.4 per cent as opposed to the general mortality of 10.4 per cent.

Pennoyer, in a recent paper read before the New York Surgical Society, presented a study of 300 cases from the Roosevelt Hospital, New York, where the surgeons prefer to allow the attack to subside before operating. In order to leave no doubt as to the acuteness of the attack, he included only patients who had had a temperature of at least 101°F. and a leucocytosis of 12,000 or more. The general mortality was 10 per cent. Among the 59 patients operated on as emergencies the mortality was 25 per cent, and represented half the fatalities in the whole series.

It is but fair to emphasize that in both Branch and Zollinger's and in Pennoyer's series immediate operation was performed in only the seemingly urgent cases, and these were not necessarily early cases reckoning from the onset of the attack.

Graham of Toronto champions a conservative attitude. It is his practice to withhold operation until the temperature is normal unless the condition is becoming worse. He reported a mortality of 5.8 per cent in a series of 68 operative cases.

In the St. Luke's Hospital series, 127 patients were operated upon in the first twenty-four hours after admission with a mortality of 13 per cent. In the remainder the death rate was 6 per cent. The author concludes that patients with fulminating conditions contribute to a high early mortality, and those depleted by long illness and advanced pathological changes, to a rising late mortality.

After subsidence of the clinical symptoms there is less risk from intervention than when it is carried out during the acute phase of the condition. Among 164 patients operated on while still febrile, the mortality was 12 per cent, as opposed to 5.2 per cent among 192 who were afebrile.

Discussion. It seems plain from the foregoing that the question of immediate versus delayed intervention cannot be settled as yet by the statistical method. In the meantime it is the opinion of the writer that no rule can be laid down and that each case must be judged on its own merits.

There always will be, of course, urgent cases which will require operation at once and contribute disproportionately to the mortality. However, if a patient is seen in the early stage of the disease and is a good risk, particularly if his symptoms are not severe, a prompt cholecystectomy should not be attended with high mortality, and it forestalls the dangers of later complications.

In the case of the average patient who is admitted with definite, but not urgent, symptoms, particularly if he is middle-aged or older, it is better to wait if possible for subsidence of the temperature. If, however, improvement is not reasonably prompt, one should intervene without undue delay unless the individual is a poor risk.

CAVE summarized his opinion in a paper before the American College of Surgeons in October, 1937, as follows: "In the majority of these cases it is far better that these patients be observed for twenty-four or thirty-six hours or even longer, to see whether or not the temperature, pulse rate and blood count will diminish, indicating a subsidence of the inflammatory process. When the temperature remains elevated after thirty-six to forty-eight hours, the pulse rapid, and the general appearance is not improving, we do a cholecystectomy or cholecystostomy."

CONCLUSIONS

The management of acute cholecystitis cannot be laid down by rule, but calls for individual judgment.

In general, patients whose symptoms have subsided are better risks.

One should be prepared to intervene promptly if progress is unsatisfactory.

Caution is indicated particularly in older patients, who furnish a large proportion of the fatalities.

NORMAN C. BULLOCK, M.D.

Pennoyer, G. P.: Results of Conservative Treatment of Acute Cholecystitis. *Ann. Surg.*, 1938, 107: 543.

The author has made an analytical study of 300 consecutive cases of clinically acute cholecystitis treated in the Roosevelt Hospital, New York City, since 1917. There were 30 deaths, or a mortality of 10 per cent.

It has been the policy at this hospital never to operate immediately upon patients suffering from acute cholecystitis, but to wait until the acute symptoms have subsided. Fifty-nine of the 300 patients or about 20 per cent, were operated upon within twelve hours after admission; 32, or over one-half of them, had had incorrect diagnoses. Fifteen, or 25 per cent of this group, died, which accounts for half of the 30 deaths in the entire series. Of the 241 patients so treated, 12 died, a mortality of 5 per cent. Twenty per cent of the entire series of 300 patients showed at least some gangrene of the gall-bladder wall, and half of these had rupture with resultant local peritonitis. There were only 7 cases of general peritonitis and of these, 4 were so atypical that they

were not recognized as originating from gall-bladder disease. Only 1 patient with typical acute cholecystitis developed general peritonitis while under observation.

The paper is discussed by Cutler, Whipple, Douglas, and Graham. ELLA M. SALMONSEN.

Glenn, F.: The Early Surgical Treatment of Acute Cholecystitis. *Am. J. Surg.*, 1938, 39: 186.

The author presents his experience with early surgical treatment of acute cholecystitis, an experience which now comprises 170 consecutive cases of patients in the early stages of the disease, treated at the New York Hospital in the past five years.

The clinical diagnosis of acute cholecystitis has been based upon a careful evaluation of the history given by the patient, and on the symptoms and the signs elicited by physical examination. In the typical case a fairly long history of recurring episodes of gall-stone colic frequently precedes the onset of the acute attack; there may, however, be no record of previous symptoms referable to the biliary tract. The pain is severe, is located in the right upper quadrant of the abdomen, and often radiates to the back or shoulder. Nausea and vomiting frequently accompany the onset of pain. The physical examination reveals marked tenderness in the right upper quadrant, associated sometimes with muscular rigidity in this area. The gall bladder may be palpable as a distended and tender mass. The patient looks ill, has a rapid pulse, some fever, and an elevated leucocyte count. Many patients whose attacks have lasted more than twenty-four hours show a mild degree of jaundice.

A considerable number of the 170 patients failed to present the characteristic manifestations of acute cholecystitis. In some there was no fever; in others the leucocyte count was normal, and in still others the symptoms were not acute and, therefore, gave little hint of the seriousness of the inflammatory process. In these atypical cases the final differential diagnosis was made on the basis of the findings at operation and the pathologist's report.

At the operating table the surgeon finds a reddened, distended gall bladder with thick, edematous walls. In addition to one or more stones, the organ usually contains colorless bile or pus under pressure. On close inspection, areas of necrosis and gangrene of the wall may be noted, and in some cases a frank perforation will be found, with inflammatory reaction around the gall bladder and adhesions between it and the neighboring structures. Free perforation with general peritonitis also may occur. On gross pathological examination, an acutely inflamed viscus, with congested and edematous walls and areas of necrosis, is described; microscopically, the specimen shows polymorphonuclear infiltration with desquamation of the epithelium and necrosis of one or all layers of the gall bladder.

All of the 170 cases reported in this series fulfilled the above clinical and pathological criteria for a diagnosis of acute cholecystitis.

The author reviews the cases of acute cholecystitis by means of 3 charts.

CHART I.—170 CONSECUTIVE CASES OF ACUTE CHOLECYSTITIS TREATED SURGICALLY FROM SEPT. 1, 1932, TO SEPT. 1, 1937

Average age	46 years
Average duration of symptoms	2½ years
*Average temperature elevation on admission	43° C
Average white blood count on admission	12,086
Mortality rate for entire group	3.5 per cent

*Normal temperature 37° C.

CHART II.—170 CASES OF ACUTE CHOLECYSTITIS

Diagnosis	No.	Deaths	Mortality rate per cent	Average white blood count	Average age
Acute cholecystitis	117	3	2.56	11,587	43
Acute cholecystitis with gangrene	38	1	2.6	12,883	47
Acute cholecystitis with gangrene and perforation	15	2	13.3	15,003	48

It is interesting to note from Chart II that the leucocyte count and the mortality rate increase with the extension of the inflammation; that after perforation the mortality is very high; and that the majority of patients with perforation are in the older age group (fifty or more years of age).

CHART III.—DURATION OF DISEASE AND MORTALITY RATE

Duration	No.	Deaths	Per cent mortality
Less than 1 month (12 with initial attacks)	41	0	0
One to six months	17	0	0
Six months to one year	11	0	0
One to five years	56	2	3.5
Five to ten years	20	2	10
Ten to twenty years	20	2	10
Twenty years and more	5	0	0

Age Incidence and Mortality Rate

	Cases	Per cent mortality
Patient under fifty years of age	116	1.7
Patient over fifty years of age	54	7.4

From Chart III it is apparent that the longer the disease is allowed to persist without surgical intervention, the graver the risk of operation when an acute attack occurs. In the cases of 69 patients with symptoms for less than one year, no postoperative death occurred; in 101 patients with manifestations of gall-bladder disease for longer than one year there were 6 deaths. Age, also, is shown to have a bearing on the outcome of the operation.

In summarizing the information given in the charts, it may be said that two factors, besides the extent of the inflammatory process, have a definite bearing on the outcome of operation in acute cholecystitis. The first of these is the duration of symptoms referable to the gall bladder before the onset of the acute attack for which surgical treatment is undertaken; the second factor is the age of the patient at the time of operation.

The mortality was not high in cases of uncomplicated, acute inflammation, but gangrene and gangrene perforation added seriously to the danger of a fatal outcome.

As to the question of complications after operation, there is nothing to indicate that these are influenced by the time at which operation is performed. Much more significant in this respect is the age of the patient and his general condition before operation. The author believes that if time is taken to counteract such conditions as dehydration and cardiac decompensation, and the operation is planned so that it places little additional burden on a sick patient, the incidence of complications after operation for cholecystitis in the acute stage is no higher than after cholecystectomy in chronic cholecystitis. NORMAN C. BULLOCK, M.D.

Whipple, A. O.: The Surgical Therapy of Hyperinsulinism. *J. internat. de chir.*, 1938, 3: 237.

Hypoglycemia may be caused by disturbances of the physiology of the liver, the anterior lobe of the hypophysis, the adrenal cortex, the thyroid, the sympathetic nervous system, and the hypothalamus, and may also occur as a result of over-active islet tissue in the pancreas. The blood-sugar level is maintained as the result of an interplay of these same organs.

The characteristic syndrome of this condition consists of attacks of nervous or gastro-intestinal disturbances coming on in the fasting state, associated with a hypoglycemia with readings below 50 mgm. per cent, which is relieved immediately by the ingestion of glucose. Unless this triad is present, the patient should not be considered for operative therapy.

The nervous manifestations in these attacks may be grouped under three main heads: (1) those related to disturbances of the sympathetic nervous system appearing as nausea, sweating, pallor, flushing, chilliness, and syncope; (2) those related to the central nervous system, manifested by restlessness, tonic or clonic muscle spasms, opisthotonos, and convulsions: and (3) those coming under the heading of psychic disturbances, such as apprehensiveness, confusion, disorientation, mania, unconsciousness, and coma.

In none of the proved islet tumor cases was the fasting blood sugar found to be above 60 mgm. per cent.

The gross and microscopic picture of these tumors reveals: (1) a diffuse hypertrophy or hyperplasia of the islet; (2) an adenoma of the islet tissue; and (3) carcinoma of the islet tissue. The most severe hypoglycemia was found in patients with carcinoma of the islet tissue. When more than one adenoma was found, a different arrangement could be seen in the two or more adenomas with varying amounts of degeneration.

There are many patients with mild hypoglycemia due to over-active islet tissue, who respond to conservative therapy. The conservative measures may be divided into dietary and gland therapy. A diet which is low in carbohydrates and high in fat has been advised, as well as one which is high in protein.

Certain measures and technique for the surgery of islet tumors have been suggested: intravenous pre-operative administration of 1,000 c.cm. of 5 per cent glucose in normal saline solution, and transfusion if necessary; spinal anesthesia, but more often drop ether anesthesia; the curved transverse incision through both recti followed by the division of the gastrocolic omentum, which provides a free inspection of the entire pancreas. Islet tumors are most frequently found in the tail or body of the pancreas, and if not easily found there the body should be mobilized and palpated; if they are not found in the tail or body of the pancreas, the duodenum should be mobilized and the head of the pancreas palpated. If one adenoma is found, careful search should be made for more; drainage is not necessary unless there is leakage of the pancreatic duct. If no tumor is found after a very complete exploration, the results in cases in which the body and tail have been resected are much better than those in cases in which a small portion of the tail has been removed. It is advisable to remove the spleen as well, in order to control hemorrhage. The bed of the pancreas should be drained after ligation of the pancreatic duct. The use of fine silk has been found satisfactory and will prevent the digestion of ligatures, which occurs when catgut is used in pancreatic tissue.

The finding and removal of all islet tumor tissue give brilliant and lasting cures of the hypoglycemic state.

The author states that when an islet tumor was found and a partial pancreatectomy was done, poor results were obtained as a rule because of an overlooked adenoma or hyperplastic islet tissue.

There was a total of 56 cases in this series which were operated upon with disclosure of a tumor. There were 43 patients with islet-cell adenoma and 13 with islet-cell carcinoma. Of these, 5 died postoperatively and 5 died of other causes; 1 showed no improvement after one year and 4 gave insufficient data; 41 had relief of the hypoglycemia. Thirty-one patients had been followed for more than one year, and 7 were followed for a period of more than five years.

Of the patients in whom resection was performed and no tumor was found, 4 died postoperatively, 10 had complete relief of symptoms, 4 showed improvement in their condition, 13 showed no improvement, and 3 gave insufficient data. Eighteen addi-

tional cases of hypoglycemia with islet-cell tumor, which came to autopsy, are presented from the literature. Seven cases of hypoglycemia in which no tumor was found at autopsy are also presented. The author records the total number of operated cases in the literature, and reports the results obtained in these cases up to January, 1938.

RICHARD J. BENNETT, JR., M.D.

Ransom, H. K.: Carcinoma of the Pancreas and Extrahepatic Ducts. *Am. J. Surg.*, 1938, 39: 264.

A group of 109 cases of carcinoma of the pancreas and extrahepatic bile ducts, verified by operation or autopsy, has been reviewed. The disease occurred approximately twice as frequently in males as in females, and the average age of the patients was fifty-six and nine-tenths years. Weight loss was the most common symptom; it was usually extreme, averaging 13.8 kgm., and it occurred rapidly. Jaundice was the most common chief complaint and abdominal pain the most common initial symptom; the average duration of the symptoms was five and five-tenths months; jaundice was the most common physical sign and was present in over three-fourths of the cases.

Courvoisier's law was of relatively little value in making a correct diagnosis prior to operation, but it was of considerable value to the surgeon at the time of laparotomy, as it indicated the type of duct obstruction which was present. The operative findings proved the law to be accurate in over 80 per cent of the cases. Laboratory studies were of practically no value in diagnosis while roentgenological studies were positive or suggestive in one-fourth of the cases. In the non-icteric patients the difficulties in diagnosis were greater than in the icteric group. In the former cases the condition was most often confused with carcinoma of the stomach or colon. Evidence of antecedent infection of the biliary tract, as indicated by contraction of the gall bladder or thickening of its wall, was noted in approximately one-eighth of the operative cases, while calculi were present in the gall bladder in one-sixth.

Cholecystogastrostomy was regarded as the best palliative operation. The operative mortality for this procedure was 29.17 per cent. In 10 cases, according to the diagnoses made at the time of operation, the ratio of cases of carcinoma of the pancreas to that of the bile ducts was 2 to 1. Autopsy examination of these same cases proved that the ratio was 1 to 2. In 3 cases of carcinoma of the ampulla of Vater, transduodenal resection was performed, with 1 postoperative death and 2 recoveries. Hemorrhage was the most common cause of death following operation. The average duration of life following palliative biliary gastro-intestinal anastomosis was seven and two-tenths months in a group of 21 patients traced. Post-mortem examination showed the most common site of metastases to be the regional lymph nodes, while metastases to the liver and lungs occurred next in frequency. In the group of 30 cases examined post mortem, there were 4 instances of multiple malignancy.

JOSEPH K. NARAT, M.D.

GYNECOLOGY

UTERUS

Pickhan, A.: Certain Viewpoints on the Irradiation Therapy of Carcinoma of the Cervix (Gesichtspunkte zur Strahlenbehandlung des Gebaermutterhalscarcinoms). *Strahlentherapie*, 1937, 60: 505.

The author discusses the evolution of the laws of irradiation therapy which have as their goal the local destruction of malignant tumors and the stimulation of the histiocytic defense mechanism, or, at least, they aim not to damage the function of the defense mechanism. In that portion of this work which deals with the physics of irradiation, the modern problem of dosage is discussed, especially the problem of radium dosage in roentgen units. Four methods are available: (1) the ionization method, (2) the mathematical method, (3) the photographic method, and (4) the biological method. The author has used the mathematical method for testing the dosage of his apparatus. An illustration shows the curves of isodoses of a single radium applicator during simultaneous radium implantation in the cervix and vagina. The sharp drop in dosage at a distance from the applicator is clearly shown, which is definite evidence supporting the use of radium for local irradiation and the addition of x-rays for irradiation of the periphery. All four groups of cervical carcinoma are treated radiologically by the author. In large exophytic tumors he succeeds (with one or two preliminary radium irradiations with 40 mgm. of radium over a period of thirty hours) in causing the tumor to regress sufficiently in eight or ten days to permit further intracervical therapy. The average dose is from 7,000 to 8,000 mgmh. (corresponding to from 25,000 to 26,000 roentgens. Radium needling, formerly employed, has been discontinued since the author observed numerous thromboses. In Groups I and II deep x-ray irradiation is added as a prophylaxis. Large fields measuring 20 by 24 cm. are used. The skin-target-distance is 42 cm.; half protection, layer, 1.3 mm. copper; 22 roentgens are given per minute, making an average dose of 3,500 roentgens on the surface (abdomen, sacrum, and vulva). Lateral fields are not used because of the danger of bone damage. In Group III, x-ray irradiation surpasses the value of radium irradiation. In Group IV radium is not used at all. In Groups III and IV the total period of x-ray irradiation lasts two months since single surface doses amount to only 120 or 140 roentgens. Attention is called to the dangers of radium irradiation in the presence of sloughing, infected tumors. Postoperative irradiation is used in all cases treated surgically on the gynecological service. Preoperative irradiation is also used when the operability or non-operability of the individual case is uncertain. The results of this method are discussed in another chapter.

With the help of the Tumor Aid Organization, accurate statistics are being gathered by the National Health Bureau (Pohlen). Detailed description is given of the methods employed in gathering these statistics. Because of the strict organization no case can become lost. The author quotes figures which were derived according to the regulation covering deaths, and set up according to scientific and statistical points of view. A total of 1,536 cases were gathered. One hundred and twenty-nine patients died within six months after beginning treatment for carcinoma; 13 died of other causes; this gives a mortality of 9.5 per cent for the first six months. Diagrams show the order of deaths of the "symptom-free" cases. From these diagrams it is possible to determine the percentage of cures following treatment for each year. One third of all the patients survived without recurrence for a period of ten years. Patients treated exclusively by irradiation therapy presented better results than those treated by combined methods. In Group I, 56 per cent were free from recurrence in the tenth year; in Group II, 25 per cent, and in group III, 15 per cent. These figures hold if the patient survived the first six months without recurrence. Calculations of the direct cures show: Group I, 42 per cent; Group II, 21.5 per cent; and Group III, 6.9 per cent. Many important figures cannot be included in this abstract. They can be obtained by consulting the curves in the original article.

(Kirchhoff). Harold C. Mack, M.D.

MISCELLANEOUS

Rydberg, E.: Some Cases of Metropathia Hemorrhagica and Secondary Amenorrhea Treated with Gonadotropic Hormone (Einige Faelle von Metropathia haemorrhagica und sekundaerer Amenorrhoe behandelt mit gonadotropem Hormon). *Acta obst. et gynec. Scand.*, 1938, 18: 1.

Four cases of secondary amenorrhea and 2 cases of metropathia hemorrhagica were treated with large doses of "physex," a high-potentiated placental or chorionic type of gonadotropic hormone, secured from the urine of pregnant women. The author was led to attempt the treatment of the cases of amenorrhea by the consideration of the success of the placental hormone, which apparently acts as a nonspecific stimulator of a sub-potent sexual organism in cases of cryptorchidism in the male. Although the time is too brief and the cases too few to allow of any considerable conclusions, apparently normal menstrual bleeding and luteinization of the curetted endometrial specimen appeared in all 4 of the cases. The patients were all young women, and from 4,000 mouse units and upward of the hormone had been administered in each case. The author thinks that, as an agent which will stimulate the torpid sexual

organs is most keenly needed at the present time, and as the placental hormone seems to have the desired effect on the ovary, this hormone should be accepted for the treatment of amenorrhea.

In the 2 cases of hemorrhagic metropathia, one of the juvenile, and the other of the preclimacteric, type, curettement disclosed the usual histological picture of glandular, cystic hyperplasia. In the juvenile case, 700 mouse units and in the preclimacteric, 7,000 mouse units, were administered intramuscularly, and a few days later diagnostic curettement showed the endometrium to be in the stage of secretion (luteinization). Of course the effects of the hormone therapy in these 2 cases were perhaps temporary, but the effect, immediately on the ovary and secondarily on the endometrium, was as good as demonstrated.

(This "physex" must not be confused with the old "physex," which was prepared by the same manufacturer, and also from the urine of pregnant women.)

The author regards 1 mouse unit of this new highly potentiated "physex" as equivalent, in dosage effect, to 8 rat units of "prolan" and to 2 rat units of "Antuitrin-S."

In the discussion following Rydberg's report, WESTMAN maintained that treatment with the follicular hormone of the ovary (estrin) is more than a mere substitution therapy, and that he had seen estrin have a favorable effect on the course of menstruation, apparently by stimulation of the hypophysis.

In answer to Westman's assertions, RYDBERG admitted the possibility that estrin could influence the hypophysis and merely affirmed that although menstrual-like bleeding may be produced with the ovarial hormone, histological examination of the endometrium had always in his hands shown it to be in the proliferative stage.

JOHN W. BRENNAN, M.D.

Donald, H. R.: The Female Climacteric and the Menopause. *Brit. M. J.*, 1938, 1: 727.

The author emphasizes the difference between "menopause" and "climacteric." The former term should be restricted to its literal meaning of the cessation of the menses. While the cause for the permanent amenorrhea is not known, it is accompanied by two principal endocrine changes. There is a relative decrease in the circulating estrogens, which are almost or completely absent from the blood stream in at least 50 per cent of women three years after cessation of the menses. The second change is an increased content of prolan A in both the pituitary gland and the urine.

The climacteric refers to an era during which there is a summation of numerous independent factors which result in a chronic state of potential nervous disharmony, which need bear no relation to the menopause, but which may mature or be activated many years later. The changes lack uniformity and vary greatly in severity. The most distinctive mental change is a progressive introversion of the mind, with depression, inertia, and insomnia. Other symptoms are headache, dizziness, various rheumatic affections, and swelling of the extremities or face.

From the clinical viewpoint there is little doubt that involuntary changes affect glands other than the ovaries. There may be mild degrees of myxedema or hyperthyroidism, and diabetes. Several cases bearing a striking resemblance to Addison's disease have been observed. Thus it will be seen that the climacteric differs from the menopause in being a general rather than a local disturbance, and in being a chronic immeasurable clinical state rather than a clear-cut observable symptom.

The menopause and the climacteric may not always possess a close temporal relation. The onset, severity, and chronicity of the climacteric depend upon: (1) the fundamental constitution of the individual; and (2) the individual degree of endocrine change which occurs at the climacteric. Such changes are extremely variable, however; moreover, the severity of climacteric symptoms need not be proportionate to the degree of endocrine change.

In from 80 to 90 per cent of women the menopause is closely related to the onset of climacteric symptoms, but the latter may precede or follow the establishment of amenorrhea by a number of years. A number of cases illustrating the delayed onset of climacteric symptoms are presented.

The author believes that x-rays, gonadotropic preparations, insulin, thyroid, testosterone, luteal hormone, and estrin all have a place in the treatment of climacteric symptoms. It is rarely necessary to give more than 1 mgm. of estradiol two or three times a week to relieve the symptoms of the natural climacteric due to a lack of estrin.

DANIEL G. MORTON, M.D.

Durupt, A.: The Dosage of Folliculin in Women; Criticism of the Results; and Study of a New Test (Le dosage de la folliculine chez la femme; critique des résultats et étude d'un nouveau test). *Gynéc. et obst.*, 1938, 37: 183.

The value of the dosage of follicular hormone in women has not been adequately demonstrated. After a number of years the clinicians realize that the activity of the ovarian secretions has been a delusion.

Errors arise in the interpretation of published results because of the difference in standardization of the hormone, titration variation which occurs with different rats and in different rat races, difference in alimentation, and the presence of Vitamin A. The technique of administration, the cycle of injection, and, lastly, the vehicle or solvent change completely the sensitivity of the animal.

The author has taken into consideration all of these factors of error and has attempted to eliminate them in his investigative work. He believes that rat units are not exact and stable, whereas the international unit, equivalent to 0.1γ or one-tenth of a

millionth gram, is well defined and therefore more satisfactory. The international unit is defined as the smallest dose of the active product capable of producing the same biological reaction as 0.1γ of the crystallized folliculin.

The so-called Doisy and Curtis method of opening of the immature mouse vagina is favored by the author, and he has used this method for studying the dosage of folliculin.

Results of the effect of varying doses of aqueous solutions of crystallized folliculin in daily injections of equal volume but decreasing concentration over a period of three days with reference to the opening of the vagina in 7 mice are presented in tabulated form.

A second table is presented showing the results of only one injection of the same solution but with oil as the vehicle instead of water. The results show that the oil solution is more feeble than the water solution administered over four days in fractionated doses.

From his study the author concludes that the test of Doisy and Curtis is equally as sensitive in the immature mouse as the test of Allen and Doisy on the castrated mouse, and 5 times more sensitive than the latter if carried out on castrated rats. The vagina opens after 3 daily injections of 0.5 c.cm. of aqueous solution containing 0.17γ of folliculin, or after one injection of 0.25 c.cm. of oily solution containing 0.25γ of folliculin. The test is established by the simple opening of the vagina. The test of Allen and Doisy (cellular keratinization) on the immature mouse is much less sensitive and should not be used. The intensity of the test is proportionate to the dosage used in the aqueous solution but not in the oil solution. GEORGE C. FINOLA, M.D.

Frankl, O.: The Frequency of Genital Carcinoma in the Young (Die Haeufigkeit des Genitalcarcinoms bei Jugendlichen). *Zentralbl. f. Gynaek.*, 1938, p. 38.

After a survey of the views of other authors expressed in the literature up to the present, the author presents his own statistical material concerning the incidence of genital carcinoma in the young. His figures are of importance especially because they represent entirely his own work and judgment. Only those cases are included in which histological proof of carcinoma could be shown. For statistical contrast, the years from 1908 to 1918 and from 1926 to 1937 were chosen. The total number of cases for the first decade was 1,035; for the second decade, 1,409. Metastatic neoplasms and granulosa-cell tumors were excluded. The classification of carcinoma of the various portions of the genital tract (cervix, vagina, vulva, ovaries, tubes) was practically the same in both periods.

The absolute increase in cases of carcinoma in the last period was a result of an increase in the total number of patients. No higher incidence of cervical carcinoma was seen among young women. Between the ages of twenty-six and thirty, a more favorable incidence was noted in the years from 1926 to 1937, namely 3.2 per cent, as opposed to 3.5 per cent in the years from 1908 to 1918; the incidence below the age of twenty-five years remained approximately the same, namely, 0.5 per cent. A slight though definite increase was noted in the frequency of corpus carcinoma in women under forty years of age. While, in the years from 1908 to 1918, not 1 of the 75 women with carcinoma of the corpus was under forty years of age, 8 of 127 women observed in the years from 1926 to 1937 had corpus carcinoma at an age less than forty years. In contrast, only 16.5 per cent of the women of the second period became affected between the ages of forty-one and fifty years. In the first period 26.6 per cent of the women developed carcinoma during these years. The numerical distribution of women affected between the ages of fifty-one and sixty was the same in both periods. A very slight increase of ovarian carcinoma was noted during the second period among very young women. It would be incorrect, however, to state that there was an increased incidence of carcinoma among younger women. There was no increase among the younger women of the last decade of carcinoma of the tubes, vagina, and vulva. Below the age of twenty-five there was an increase from 0.6 to 0.9 per cent for all types of genital carcinoma. However, since the percentage in the third decade was still less than one, this slight increase is of no significance; the difference still lies within the possibilities of error of any statistical method. No conclusion that carcinoma is on the increase among young women was therefore justified.

(G. SCHAEFER). HAROLD C. MACK, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Samuels, J.: An Accurate Method of Determining Ovulation and Pregnancy (Eine exakte Methode zur Ovulations- und Schwangerschaftsbestimmung). *Jap. J. Obst. & Gynec.*, 1937, 20: 579.

In a patient who had suffered with primary amenorrhea and had been cured by the short-wave method, it was found that one day before a menstruation the system was completely balanced in the endocrine electrodiagram with values around 180; seven days after menstruation the endocrine system was also in balance, but all the values were around a normal of 150. This led to the thought of determination of the daily reduction figures of the oxyhemoglobin in a normal female before and after menstruation. It was found that these values showed typical variations during the menstrual cycle, whereby the rise and fall of the gaseous metabolism could be determined in a simple manner as an index of the hormone content before, during, and after menstruation and during ovulations. Such a curve is called a cyclogram. This also has importance in the problems of conception and abstinence. The cyclogram shows how extremely accurately these reduction values indicate the amount of hormone content—the amount of activators and regulators of the gas metabolism in the blood.

The technique was as follows: A spectroscope was clamped to an interdigital fold, preferably between the thumb and index finger. This showed two dark bands in the yellow and green which indicated the absorption of oxyhemoglobin. After some time the bands became indistinct and hazy, and finally disappeared; they were then replaced by a gray, homogeneous band, which indicated the moment of completion of the reduction. After from five to seven seconds, two new bands appeared, close together, with a less broad yellowish-green interval. The entire picture was more hazy and displaced more to the left than the oxyhemoglobin bands, the absorption bands of the methemoglobin being seen. The methemoglobin bands then disappeared in from ten to forty seconds. The picture then repeated itself but at a more rapid rate.

With a simple instrument, the cycloscope, the time of reduction was determined. In normal men and women after the climacterium, in whom the endocrine system is not balanced, the examination took about one hundred and forty-five seconds. In sexually mature women the daily reduction figures varied. In a woman at the height of sexual maturity, such a daily cyclogram varied from the normal three times a month, most markedly during menstruation; the other less marked and shorter variations indicated the times of ovulation. Women between twenty-five and forty years of age ovulated twice a month; most nulliparas ovulated three times a month. The pre-ovular rise of the hormone content is a complicated process, associated with the preparation for ovulation and the increasing production of folliculin, gonadotropic hormone, and other hormones. The cyclogram is the expression of a similarly complicated process, which consists of the sudden escape of the contents of the graafian follicle, the partial interruption of the formation of folliculin and prolan, and the production of luteinizing hormone. During two laparotomies it was possible to demonstrate that the two ovaries ovulated at different times, which indicated that the women who usually show ovulation on the ninth, tenth, eleventh, or twelfth and on the seventeenth or eighteenth day of the menstrual cycle have 2 or 3 ovulations during the cycle; also that the ova develop and mature according to certain laws, and that the graafian follicles rupture independently of copulation, even though there is a certain time relationship between ovulation and menstruation.

Heretofore it was impossible to determine accurately the time of ovulation. It was always believed that a single ovum was liberated during each cycle. With the method described it has been shown that at least two ova, one from each ovary, are liberated during a cycle. As a result of the cycloscopic examination the mathematical computations of Ogiono and Knaus have been verified and it is now possible to estimate the exact day of ovulation.

The cyclogram shows the following phases: (1) the first pre-ovular climax; (2) the first ovulation; (3) the second pre-ovular climax; and (4) the premenstrual climax. The highest and lowest figures and the duration of the phases vary in different women and also in the same woman during different months. There is a difference between women with a twenty-six-to-twenty-eight-day cycle and those with a thirty-to-thirty-one-day cycle in the time and course of the menstruation. In young and sometimes in older women all the figures are higher. In younger girls, who ovulate three times, the ovulation and the second rise of the curve may occur without a pause on the same day. Exceptionally, the ovulation may last longer than usual.

The most favorable time for conception lies within the days of the falling curve of ovulation. One day later conception is uncertain and another day later it is almost impossible, as an ovum is impregnable only for two days. The problem of conception is thus solved simply.

The problem of abstinence is not so easily solved, because investigators have varying views as to the duration of viability of spermatozoa in the female genital tract. It may be said, however, that a woman is sterile after the last ovulation up to the time of menstruation. She is probably also sterile during menstruation and from three to four days

thereafter; during the rest of the cycle, conception is possible. Hence, the time of absolute sterility is longer for a woman with a thirty-one-day cycle than for one with a twenty-six or twenty-eight-day cycle; in young girls with 3 ovulations it is shorter. It has also been shown that spermatozoa travel from 2 to 3 mm. per minute and from 12 to 18 cm. per hour, hence they may reach the ampullæ in about one and one-half hours and impregnate the ovum.

It is possible to diagnose pregnancy easily by the constancy of the daily reduction figures. In recent pregnancies of healthy women in endocrine balance, there are constant daily reduction figures of from 155 to 165. From the second to the seventh or eighth month the figure is constant at about 160, and at the end of pregnancy it reaches 155. Shortly before labor the figures rise to about 165, with variations just before labor. It is assumed that the fall and the variations just before labor are associated with the changed hormone production in the hypophysis, placenta, decidua, and corpus luteum verum. In this way it is easy to differentiate between fibromyoma, "grossesse nerveuse," and pregnancy; also between ectopic pregnancy and moles.

The diagnosis of pregnancy can also be made more quickly by observation of changes in the cycle than with the Aschheim-Zondek reaction. With this method, pregnancy may be suspected on the evening of the third day after impregnation by the unusual climax of the curve; it may be assumed as probable on the fourth day by the unusual fall, and as very probable one day later. For the sake of caution the curves may be studied two or three days longer. If they remain constantly low, there is no doubt about the pregnancy's being early. In a woman with a thirty-one-day cycle who was impregnated during the first ovulation, the diagnosis could be made on the eighteenth or nineteenth day with absolute certainty seven or eight days after impregnation and about twelve days before the following menstruation; and in a woman with a twenty-eight-day cycle, who was impregnated during the first ovulation, it was made nine or ten days before the expected menstruation. If impregnation occurs during the second ovulation, the diagnosis is certain six or seven days later. In every case pregnancy can be diagnosed before the absence of menstruation. Constant figures of from 155 to 170 on four or five successive days point definitely to pregnancy both in the intermenstrual period and in the absence of menstruation.

LOUIS NEUWELT, M.D.

Kehrer, E.: Hyperemesis Gravidarum (Hyperemesis gravidarum). *Ztschr. f. Geburtsh. u. Gynaek.*, 1938, 116: 333.

This article surveys the present status of scientific research on hyperemesis gravidarum. Clinically, this condition is divided into two types; the severe toxic and the mild neurotic. The author gives an interesting example of a case of psychogenic hyperemesis. Detailed description is given of the treatment with hormones and vitamins. Other modern therapeutic measures are also discussed, such as liver therapy and serum administration.

In the consideration of therapeutic abortion, the author joins with Winter in the view that interruption should be considered only in the very severe, pernicious types of cases, complicated by other diseases, especially cerebral; this viewpoint should be generally adopted. In such instances intervention must be timely, since a fatal outcome for the woman is possible. In judging the severity of such cases, the presence of hypochloremia and azotemia are of great importance. Less important nowadays is the finding of acetonuria. The determination of the blood ketone levels, on the other hand, is of great importance. French authors stress the importance of the Maillard coefficient; the presence of icterus and subicterus should not be minimized. On the whole, such severe cases are quite rare; they may, however, occur and in such event interruption should not be delayed, especially if energetic, conservative treatment does not immediately bring improvement.

(HUESSY). HAROLD C. MACK, M.D.

LABOR AND ITS COMPLICATIONS

Apajalahti, A.: Can the Time of the Rupture of the Membranes Depend upon the Histological Structure of the Fetal Membranes? (Kann der Zeitpunkt des Blasensprungs vom histologischen Bau der Fruchthaeute abhaengig sein?). *Acta obst. et gynec. Scand.*, 1938, 18: 57.

By means of various staining methods, the fetal membranes of 40 women in whom the pelves, the amount of amniotic fluid, and the position of the fetus revealed nothing pathological were studied. The women were divided into 4 groups on the following bases: (1) premature rupture; (2) early rupture, (3) full-term rupture, and (4) retarded rupture.

The histological studies of the fetal membranes showed that the amnion and chorion were distinctly separated tissue layers. The connective tissue layer lying directly under the amnionic epithelium constituted the firmest portion of the membranes and their resistance seemed to depend mainly upon the firmness of the amnion. The chorion was a much looser retiform tissue, consisting of connective-tissue fibers, of which the demarcation from the decidua was indistinct. No elastic or muscle fibers were seen. A weakening of the color receptivity of the tissues of the amnion and chorion, from the edge of the placenta to the site of rupture of the membranes, seemed to indicate a reduction in vitality toward the site of rupture. Taking into consideration the fact that the membranes became thinner in the same direction, it seemed plausible that the resistance of the membranes diminished toward the site of rupture.

In the cases with retarded rupture of the membranes, the amnion was relatively thick, and, particularly in the subepithelial connective-tissue layer, the fibers were especially closely crowded against

one another and wave-shaped. The nuclei were well preserved. No noteworthy degeneration was noticeable, nor could any inflammatory symptoms be demonstrated.

In the cases with premature rupture of the membranes, the amnion was generally distinctly thinner. It was often edematous; the connective-tissue fibers were swollen, and lay somewhat separated. Around the nuclei there were vacuoles, and the cells had undergone degeneration. Similar changes were also seen in the chorion and the decidua, and there were also hyaline degeneration and necrotic areas, and numerous pyknic cells. The decidua revealed isolated granulocytes, but these were not attributable to an inflammation, but rather to the penetration of granulocytes into necrotic tissue.

This study seemed to indicate that the rupture of the membranes depends upon their histological structure and, particularly, upon the thickness of the amnion. The thinner the membranes, especially the amnion, and the more pronounced the degenerative changes, the easier and the sooner does the rupture of the membranes occur. A bacterial inflammation, resulting in direct adhesion of the membranes to the deeper layers of the decidua, could not be demonstrated. LOUIS NEUWELT, M.D.

PUERPERIUM AND ITS COMPLICATIONS

King, R. C.: Gynoplastic Repair Following Delivery. *Am. J. Obst. & Gynec.*, 1938, 35: 497.

The vaginal tract should be examined after every delivery, if there is no contra-indication from the standpoint of asepsis or the general condition of the patient. New lacerations and injuries should be cared for at that time.

In selected cases, and under favorable conditions, repair of old cervical and perineal injuries can be carried out with little difficulty immediately after delivery. The immediate and late results are usually satisfactory.

The immediate operation offers advantages from an economic and psychological viewpoint, while the intermediate operation has the additional disadvantage of disturbing tissues that have already started to heal.

Extensive repair of cystocele, rectocele, and enterocele, as well as of the cervix and perineum, is an operative procedure requiring more time and precision than is advisable after delivery. Such operations should be delayed until the patient has fully recovered from her delivery and the tissues have undergone complete involution.

Repair of the cervix and perineum do not prevent procidentia and uterine displacements. These conditions can be corrected only by restoration of the fascial attachments in their normal relationship. Surgical restoration at this time is inadvisable and a simpler method should be sought. Loosely packing and distending the vagina with gauze following delivery is effective in accomplishing this in some cases.

Both the immediate and intermediate operations present technical difficulties that are not present in the interval operation; but if performed in selected cases, and limited to the cervix and perineum, such operations can be recommended as offering definite advantages to the patient.

EDWARD L. CORNELL, M.D.

Chesterman, J.: Puerperal Infection Due to Hemolytic Streptococci. *Med. J. Australia*, 1938, 1: 237.

Puerperal sepsis is due to the invasion by pathogenic organisms of the raw wounds that remain after parturition or abortion. Tables and graphs illustrate that puerperal sepsis is responsible for about one-third of maternal deaths, that the death rate in Australia has remained unaltered for many years, that the hemolytic streptococcus is found in nearly 40 per cent of the more severe puerperal infections, and that it is responsible for about 80 per cent of the deaths from sepsis.

Studies by Lancefield and others have shown that hemolytic streptococci can be divided into several different types. Those producing pathological conditions in man all belong to one group, designated A. Streptococci recovered from the cervix and vagina before labor rarely belong to Group A; the women upon whom these are found seldom develop sepsis. Therefore it is reasonably certain that pathogenic hemolytic streptococci do not normally inhabit the female genital tract, but when they gain access to the genital tract of parturient women they nearly always produce a pathological state. Such infections are extrinsic and their source should be sought.

The author reports the results of 286 cervical swabbings taken from patients in the Women's Hospital, Sydney. There were two groups: (1) those taken on the third day of the puerperium from 100 consecutive women delivered in the hospital; and (2) those taken from women delivered in the hospital, or admitted after delivery outside, or suffering from abortion, who sustained a temperature of 101° F. for which no extragenital cause was found. In the first group, 11 had a febrile puerperium. Hemolytic streptococci were found in 4 febrile cases and 1 afebrile case. The former belonged to Group A, the latter did not.

Among 1,900 consecutive hospital deliveries in the second group, 122, or 6.5 per cent, had a febrile puerperium and in 1.6 per cent it was due to the hemolytic streptococcus. Of 49 patients admitted after delivery of a viable child elsewhere, 20 had a febrile puerperium; in 19 per cent it was due to the hemolytic streptococcus. Of 363 patients admitted with abortion, 51 were febrile; and in 1.1 per cent of these the condition was associated with the hemolytic streptococcus.

The following clinical and therapeutic considerations are discussed:

1. The nature of the labor; more than half were normal.

2. Parity; this had no bearing.

3. Age; the average age of the infected women was five years greater than the average age of all the women delivered.

4. The day of onset of the fever; usually on the second, third, or fourth day of the puerperium the temperature rose suddenly to from 102° to 105° F.

In the treatment, good nursing, fresh air, attention to bowel action, sleep, and a diet high in Vitamin A are emphasized. Repeated transfusions, and iron and liver therapy are advised. Occasionally it may be necessary to promote uterine drainage. Intravenous chemotherapy and specific antisera are not considered of value.

Of 57 patients, 41 were treated with sulfonamide. Four patients in this group died; 3 of the 4 had extensive infection on admission. It is the author's impression that if the infection is recognized early as being due to a hemolytic streptococcus adequate doses of sulfonamide, in addition to the other measures already mentioned, will help to prevent spreading beyond the uterus with its resultant high mortality. Toxicity from sulfonamide is discussed briefly. The importance of prophylaxis is emphasized; proper masking of the attendants, the exclusion from the delivery room of those with infected throats, the search for possible sources of infection, and the isolation of infected cases are all mentioned.

DANIEL G. MORTON, M.D.

Trillat, P., and Burthiault, R.: The Treatment of Puerperal Infection by the Continuous, Slow Intravenous Injection of Alcoholized Glucose Solution (Le traitement de l'infection puerpérale par les injections intraveineuses lentes et continues de sérum glucosé et alcoolisé). *Gynéc. et obst.*, 1938, 37: 241.

Trillat and Burthiault report 4 cases of puerperal infection, in 3 of which the blood cultures were positive, in 1 case for the streptococcus, in another for the enterococcus, and in the third case for the staphylococcus albus and the bacillus subtilis (two cultures). All of these cases were of a severe type and the patients had failed to improve with the usual methods of treatment; they were finally treated by the continuous intravenous injection of an alcoholized glucose solution. Two of the patients recovered, and 2 died. In 1, death was found to be due to an acute diffuse pulmonary tuberculosis, a latent tuberculosis having apparently been activated by the post-partum infection and by the treatment; the blood culture in this case was negative. In the other fatal case, some improvement was noted when the treatment was instituted, but it was apparently too late.

The solution employed consisted of 20 c.cm. of ethyl alcohol (95 per cent) and 50 gm. of glucose, and water to make 1,000 c.cm. It was put up in containers holding 500 gm. The apparatus was adjusted to inject 2 liters of the solution in twenty-four hours, about 30 drops per minute. As a rule the injection was continued for four days. When the treatment was first instituted the patient usually had a chill, but no further chills occurred; patients who responded well to the treatment noted a feeling of well-being after the first few hours.

This form of treatment is recommended especially in cases with repeated chills, which indicate a spread of the infection and invasion of the blood stream; even if no chills occur, the treatment is also indicated if the blood culture is positive. In the authors' patients who recovered, the treatment was not instituted until the fifth or sixth day after repeated chills had occurred daily. The presence of tuberculosis is a contra-indication to the use of this treatment. Hypertension and cardiac disease may also be considered as contra-indications. The same method of continuous drop-by-drop, intravenous injection might also be employed for the administration of other drugs in puerperal infection, such as sulfanilamide.

ALICE M. MEYERS.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Staehler, W.: Local Circulatory Disturbances of the Kidney (Zur Klinik der oertlich begrenzten Zirkulationsstoerungen der Niere). *Beitr. z. klin. Chir.*, 1938, 167: 189.

The author distinguishes arterial and venous circulatory disturbances and adds a brief report of animal experiments.

Total occlusion of the renal artery may occur acutely as embolism and chronically as thrombosis. In both instances nephrectomy must be considered. However, in acute occlusion it often fails to avert a fatal outcome both because of the underlying heart disease and because of the anuria of the sound kidney which results from secondary embolism.

The occlusion of the individual branches leads to infarcts. There is always, however, renal parenchyma which does not become necrotic. Consequently, the affected kidney is capable of excreting urine which, under these circumstances, contains much blood.

Numerous infarcts may lead to infarct-contraction of the kidney. Clinically the symptoms may be quite insignificant. However, severe hematuria, pain, suppression of the renal function, and a negative excretion-pyelogram may be observed. In 40 per cent of the cases the signs were bilateral; in from 90 to 95 per cent associated heart lesions were noted. The prognosis depends upon the severity of the heart disease and the size of the infarcts. After from two to five weeks the kidney begins to recover. Usually it should not be removed. On the other hand, when severe pains and impairment of function are present decapsulation is recommended.

Among the circulatory disturbances of the small arteries and capillaries, symmetrical cortical necrosis, the eclamptic kidney, and focal nephritis are discussed. The first two conditions are alike in that they appear in pregnancy or shortly thereafter. They are different because cortical necrosis is attributable to toxic, vasoparalytic, and degenerative changes in the terminal vessels, while the eclamptic kidney is caused by spasm of the smallest vessels. Convulsions never occur in the former but are usual in the latter. Since crises of the cerebral vessels also have a part in eclampsia, decapsulation and arterial enervation cannot basically control the eclamptic attacks.

As to the cause of the embolic focal nephritis, tonsillitis, dental granuloma, and many other suppurative diseases are to be considered. Focal nephritis may disappear rapidly, but may also persist for years and evoke frequent, painful recurrences. According to Kretschmer, half of the cases of essential hematurias are in reality cases of circumscribed glomerulonephritis. The removal of the original focus is therapeutically most important.

Three varieties of renal venous thromboses are to be distinguished: the propagated extrarenal type, the renal inflammatory form, and the marantic venous thrombosis of nursing infants. Severe hematurias necessitate nephrectomy.

In animal experiments, the clamping of the renal artery for a period of from two to four hours resulted in the deposition of calcium in the cortical portion of the kidney. These deposits were capable of retrogression. (Buettner). J. M. Salmon, M.D.

Davis, D. M.: Conservative Methods in the Surgery of the Chronically and Severely Infected Kidney. *New England J. M.*, 1938, 218: 947.

Of the commoner urological operations, nephrectomy for pyonephrosis shows the highest operative mortality, although the author found difficulty in determining the exact figure because the term "pyonephrosis" is applied by various persons to different lesions. The figures are confusing and unsatisfactory, and do not permit the establishment of proper standards for the treatment of pyonephrosis; they vary tremendously and must, therefore, be regarded with a shrewdly appraising eye. There is no distinct dividing line between pyonephrosis and infected hydronephrosis, and the term "pyonephrosis" conveys no information as to the existence or severity of complications, which are of the utmost importance to the surgeon.

As a matter of fact, it makes little difference whether the obstructed kidney is filled with pus or with clear, sterile urine, so long as there is no perinephric inflammation; the pyonephrosis is then devoid or almost devoid of perinephritic changes, and the operative difficulties are minimal. The disease runs a milder course, and even if the infection is acute and preliminary nephrostomy is necessary, the secondary nephrectomy should be easy. The results in cases of this type should be good if the opposite kidney is healthy. For these cases the term "pyonephrosis" should be abandoned in favor of the term "infected hydronephrosis," regardless of the character of the renal contents.

There is another group of cases in which the perinephric inflammation plays a most important part. Abscesses may occur, but fibrosis is inevitable, and this determines whether the surgical problem will be easy or difficult. The fibrosis may vary in amount and location; it may be very extensive about the kidney, and yet not obliterate the line of cleavage between the kidney proper and the inner surface of the true capsule. It is upon the latter pathological fact that the operation of subcapsular or intracapsular nephrectomy is based. This operation avoids the separation of dense and widespread adhesions, with the danger of traumatic shock or injury to other vital organs, such as the vena cava, aorta, pleura, intestine, pancreas, and liver. In some cases

of pyonephrosis the line of demarcation between the kidney and its capsule may be partly or entirely obliterated, leaving, in extreme cases, nothing but the infected cavity of the renal pelvis surrounded by dense scar tissue, without even microscopic remains of kidney tissue. The problem in such cases involves three other possible factors: (1) a congenital anomaly, such as horseshoe kidney, double kidney, ectopia, or polycystic disease; (2) disease of the opposite kidney, which requires simultaneous treatment or restricts the available alternatives; or (3) general disease which may diminish the resistance of the patient. Therefore, in the cases of pyonephroses with perinephritic fibrosis there are the greatest variations in operative suitability and prognosis.

The author has despaired of achieving a pathological classification simple enough to be useful in the more accurate evaluation of the success or failure of surgical treatment. The operations available under these circumstances are lumbar extracapsular nephrectomy, lumbar intracapsular nephrectomy, transperitoneal nephrectomy, and permanent nephrostomy. Since it is better to admit that it is sometimes impossible to remove the kidney and save the patient, the author thinks that other possible methods should be developed.

If nephrectomy may possibly be avoided for a good reason, the most complete information about the condition present should be sought. If it is so severe that immediate operation (usually nephrostomy) is necessary, certain studies may be made later. In a less severe illness, the usual thorough urological study is made. With pyelography it is possible to draw from the nature of the pelvic outline fairly accurate inferences as to the degree and location of the perinephritic fibrosis. If secondary nephrectomy is considered inadvisable, the nature of the problem hinges upon whether or not the kidney is still able to secrete urine. If the kidney is still secreting considerable urine, nephrectomy can be avoided only by providing adequate drainage. Except with permanent nephrostomy, this may be accomplished only by restoring the ureteral function by dilatation or a plastic operation. If the kidney secretes only a small amount of urine, efforts may be made to remove remaining portions of the parenchyma by fragmentation, to interfere with the remaining blood supply, or to cause atrophy by chemicals or deep x-ray application. If such efforts succeed, urinary secretion is permanently suppressed and the following considerations apply:

If the kidney produces no urine, the condition is that of an infected cavity (only the renal pelvis, pelvis and dilated ureter, or an added cavity of a perinephritic abscess). All of these heal if adequate drainage is provided for a sufficiently long time. The drainage aperture must be of generous size, and drainage materials must be kept in place until firm healing occurs from the bottom of the cavity. The ureter in such cases must be given careful attention. If it is not dilated, the obstruction is at or near the ureteropelvic junction and no special attention is necessary. However, if the ureter is dilated, the nature of the obstruction becomes important. Dilatable strictures require suitable dilatation and respond well to this procedure. If dilatation is impossible, the ureter should be treated before attacking the kidney, either by a plastic or some other operation to restore its patency, by removal through an inguinal incision, or by bringing it to the surface and draining it thoroughly. Such operations should be carried down to the point of obstruction.

Observations at the operating table determine the procedure to be followed in the region of the kidney. If nephrostomy is done, the presence or absence of urine in the drainage can be determined. In doubtful cases, the urea content is decisive. Functional studies can be made with phenolsulfonphthalein and indigo carmine. Colored solutions injected into the drainage tube show whether any of the pelvic contents reach the bladder. Roentgenographic studies are the most instructive. The pyelographic medium is easily injected directly through the drainage tube. Fluoroscopy during the injection shows whether the fluid is reaching the bladder, and also how quickly and completely the pelvis empties. If ureteral drainage has become adequate, blocking of the drainage tube for twenty-four hours answers the question. These methods and a thoughtful interpretation of the findings make for accurate and reliable preoperative diagnoses, which permit the selection of the best and least dangerous procedure for relief.

LOUIS NEUWELT, M.D.

Leadbetter, W. F., and Burkland, C. E.: Hypertension in Unilateral Renal Disease. *J. Urol.*, 1938, 39: 611.

The authors review the literature concerning the experimental production of hypertension in animals by constriction of one or both renal arteries. They also mention the case of a patient of Lewis, in whom hypertension was relieved by nephrectomy of a kidney containing an infarct.

Their own case demonstrates the clinical application of experimental work which has been done. A five and one-half-year-old colored boy with hypertension of three years standing was apparently cured by the removal of an ectopic kidney, the main artery of which was partially occluded.

The authors believe that their experience should stimulate the search for unilateral kidney pathology in cases of malignant hypertension in which sympathectomy or excision of adrenal tissue is being considered.

THEOPHIL P. GRAUER, M.D.

Boyd, C. H., and Lewis, L. G.: Nephrectomy for Arterial Hypertension. *J. Urol.*, 1938, 39: 627.

The authors report the case of a man thirty-one years of age with arterial hypertension, showing typical eye-ground changes, and who, a number of weeks previously, had given a history of acute abdominal pain.

Both adrenal glands were explored and found to be normal, but a large infarct was observed in the

right kidney. A right nephrectomy was performed, which was followed by a slow reduction of the blood pressure to normal. The authors believe that the reduction of the blood pressure was due to the removal of the diseased kidney, since it was gradual rather than sudden, as would have been the case had the reduction been due to partial denervation of the adrenal glands, as described by Crile.

THEOPHIL P. GRAUER, M.D.

Godard, H.: Results of Renal Decapsulation (Quelques résultats de la décapsulation rénale). *J. d'urol. méd. et chir.*, 1938, 45: 289.

According to Godard, renal decapsulation, has been employed in the treatment of postoperative anuria for the past twenty-five years, yet the method is still under investigation and extensive discussion. The results obtained with this surgical intervention are inconstant and some surgeons firmly question its value.

From his personal experiences, the author believes that renal decapsulation is positively indicated in cases in which the prognosis is hopeless.

Godard performed a successful renal decapsulation in a ten-year-old-girl, who became completely anuric after a simple appendectomy. The decapsulation was performed bilaterally and about twenty-four hours later micturition began spontaneously. A biopsy specimen taken from the kidney showed flattening of the cells lining the convoluted tubules, and Henle's loops as well as the collecting tubules were filled with desquamated epithelial cells. One year later, a kidney function test revealed a persistent renal insufficiency. Four years later the child was operated upon again and the biopsy specimen showed the presence of a chronic glomerulonephritis which, in the author's opinion, has a rather unfavorable prognosis. The renal decapsulation, however, had effected a temporary amelioration.

Encouraged by these results, renal decapsulations were performed in 2 other cases. The second patient presented a subacute glomerulonephritis following scarlet fever, and the third patient suffered from a toxic nephrosis due to mercurial poisoning. Both cases ended fatally following surgical intervention.

This problem was studied further experimentally on rabbits which were given intravenous injections of mercury and whose kidneys were subsequently decapsulated. About 40 per cent of the animals survived.

In a series of control animals which were poisoned in the same way but whose kidneys were left intact, the percentage of spontaneous recoveries was found to be approximately the same.

In another series of control animals, the author studied the urinary output as influenced by renal decapsulation. He found that immediately following the operation, the urinary output falls abruptly. The urea excretion, however, is not influenced by renal decapsulation, but this finding should be further studied for confirmation.

In general, Godard believes that renal decapsulation performed on damaged kidneys usually yields unsatisfactory results. The best results are obtained in functional disturbances of the kidney, especially those of nervous origin, such as lesions of the splanchnic and sympathetic nerves of the renal plexus and nephritis secondary to spinal anesthesia or to cerebral lesions. In these cases an anaphylactic reaction sometimes follows renal decapsulation, this being due to the proteolytic products formed at the site of the operation. This phenomenon manifests itself by a moderate hemorrhagic infiltration of the kidney, involving especially the convoluted tubules.

With reference to regeneration of the renal capsule, the author found experimentally that in the animal which has been operated upon the capsule is regenerated. In 2 animals the operation was followed by the formation of a dense fibrous perirenal capsule infiltrated in places by calcareous deposits probably derived from the destroyed glomeruli.

RICHARD E. SOMMA, M.D.

Ockerblad, N. F.: The Surgery of the Human Ureter. *J. Urol.*, 1938, 40: 101.

The surgical attack upon ureteral calculi is of comparatively recent origin. It is only since the perfection of the x-ray and of the methods of operative cystoscopy that real progress has been made. Before the days of the cystoscope and the x-rays the surgeon could only guess at the size and location of the stone. He tried to locate the calculus by the distribution of the pain, which was as likely to lead him astray as it was to lead him to the stone. Today we have a large number of cases in which ureteral stones have been removed, but general surgeons are skeptical of the possibility of removing ureteral calculi by cystoscopic means and they believe, generally, that all ureteral calculi will pass if given time.

No one knows how large a stone must be before it can be stated confidently that the stone will pass. It is safe to say that the greater number pass down the ureter and out with the urinary stream while they are as yet microscopic in size. Practically all ureteral stones originate in the kidney. The ureter is such a delicate tube that most urologists are exceedingly cautious as to how they examine it, and the surgeon who tries to extract a ureteral calculus which is above the iliac crossing may get into serious difficulty.

A calculus which has become impacted in the ureter, which has not moved for weeks or months and shows no signs of moving, is best removed by open surgery. The author reviews operations on the upper, middle, and lower thirds of the ureter. He also refers to the surgery of ureteral anomalies and ureteral diverticula. The operation of ureterectomy and of ureteral re-implantation into the bladder is also considered.

In referring to implantation of the ureters into the intestines, the author states that before attempting this procedure one should be thoroughly familiar with the steps of the operation, and that it is best

if the operation be done first on a number of dogs. It is encouraging that leading surgeons are becoming more conservative in the management of such operations.

The surgery of ureterocele, ureteral denervations, ureterostomies, ureteral fistulas, and strictures with drainage of the ureter are all briefly considered.

C. TRAVERS STEPITA, M.D.

BLADDER, URETHRA, AND PENIS

Ward, R. O.: Fifty-Three Cases of Vesical Diverticula. *Brit. J. Surg.*, 1938, 25: 790.

The author presents a clinical and critical survey of 53 cases of vesical diverticula which includes the etiology, diagnosis, complications, and surgical treatment of this condition. From his case summaries he concludes that:

1. Diverticula are rarely congenital in origin.
2. Their formation is in most cases due to an obstruction to the outflow of urine from the bladder.
3. They are rarer in the female, in which sex obstruction is uncommon.
4. Infection and calculus formation are frequent complications; neoplasms are less common.
5. Cure is obtained by diverticulectomy, combined with treatment of the obstruction, if any be present.

The author states that a vesical diverticulum does not give rise to any symptoms which are unique, and that most diagnoses are most conclusively established by cystoscopy and cystography. He points out that prostatic obstruction must be carefully sought when a diverticulectomy is performed, and that if the orifice of a diverticulum which is to be removed is at all near that of the ureter it is sound practice to pass a rather stiff bougie, which serves as a guide to the situation of the ureter.

Diverticulectomy was performed in 36 patients, with only 1 death due to the operation.

D. E. MURRAY, M.D.

GENITAL ORGANS

Walker, K.: A Survey of Prostatic Enlargement and Its Treatment. *Brit. M. J.*, 1938, 2: 53.

The author has surveyed the work that has been carried out by innumerable researchers in the laboratory and operating theater in the field of prostatic enlargement during the past twenty years and states that there is no reason to be dissatisfied with the results. Definite progress has been made both in our understanding of the cause of enlargement and in our methods of dealing with it. The investigations of the biologist and the biochemist are now leading us in a direction which may well mean that within a few years we shall be able to prevent the occurrence of this condition and possibly cure it once it has arisen.

Experiments suggest that enlargement of the prostate in man may be due to the action of an excess of estrogenic substance. It has long been known that the male body forms estrogenic as well as male hormones, and that both of these substances can be extracted from the testis. It is therefore not illogical to suppose that an upset in the normal balance between these two antagonistic principles may be the cause of prostatic enlargement. However, no direct confirmation of this theory has so far been obtained from any quantitative estimate of the hormones formed by patients suffering from prostatic enlargement. There is plenty of experimental support for the attempt to deal with human enlargement by means of endocrine therapy, either directly by the injection of male hormone or indirectly by the use of gonadotropic substances. Until recently these attempts have been handicapped by the difficulty of the injection of enough hormone to produce an effect, but with improvements in the methods of extraction and of manufacture this difficulty is being overcome.

Reference is made by the author to the original Steinach operation of ligation of the vas and to the Niehaus modification of ligation of the efferent ducts of the testicle. Surgery of the prostate and prostatic obstruction are reviewed with regard to the perineal operation, suprapubic prostatectomy, the Harris technique, and the present position of the Harris operation.

Finally, the author states that even if the efforts of prostatectomists to rid the original Freyer operation of its shortcomings have not so far met with success, there is no reason to doubt that in the end this also will be achieved.

In the meantime close co-operation between the clinicians and the designers of instruments has provided a valuable alternative method of surgical intervention in the form of transurethral resection for prostatic obstruction.

C. TRAVERS STEPITA, M.D.

Huggins, C., and Noonan, W. J.: Spermatocele, Including Its X-Ray Treatment. *J. Urol.*, 1938, 39: 784.

Of 55 patients with spermatocele, 46 were asymptomatic, 8 complained of slight pain, or a dragging sensation of weight in the scrotum, and 1 experienced some interference in walking. In the majority of patients the enlargement was not noticed until after the third decade. In none of the patients was a traumatic history obtainable, under observation, though several patients attributed the swelling to trauma of the testis. The largest spermatocele contained 1,160 c.cm. of fluid.

Spermatozoa were always found on aspiration of fluid from the cyst. Usually their number was large, which proved the existence of a direct connection between the spermatocele and the testis. The sperms, immotile after aspiration, were always activated by standing at room temperature for a few minutes. The cyst transmitted light with ease in every case, which is contrary to statements appearing in several textbooks, that a spermatocele cannot be transilluminated. Since the anatomical

mechanism causing the spermatocele is unknown, the condition may be regarded as a partial obstruction to the sperm-conducting system.

The problems of permeability of the membrane are interesting. It has been shown that while the absorption of phenolsulfonphthalein from a spermatocele is slower than absorption from subcutaneous tissue, it is much more rapid than such absorption from a hydrocele, and that fluid from a spermatocele contains no inorganic phosphate, and only traces of reducing substance such as glucose. Therefore, there is a selective permeability in this membrane, and phosphate ions do not pass from the plasma into the fluid. The injection of phosphate into a spermatocele usually was retained in high concentration for two days, which showed that the membrane was relatively impermeable to certain ions in both directions. Since many spermatozoa are present, the indication is that the fluid which surrounds the sperms coming from the testis contains no inorganic phosphate, or, at most, only small amounts.

In the cases of 33 patients no treatment was given. Resection of the spermatocele for deformity or other symptoms was done in 11 cases, and orchidectomy was done in 2 cases for infection following aspiration. Aspiration of a spermatocele is not always an innocuous procedure, and infection may occur despite clinical asepsis. Since a spermatocele always contains sperms, treatment with x-rays was tried and it was always found that it caused the cyst to disappear. Nine patients were treated according to the following technique:

The uninvolved testis was shielded with lead and the involved testis with a filter varying from 0.5 to 1.2 mm. of copper and 2 mm. of aluminum. The involved testis received from 200 to 300 roentgen units measured in air with 200 kv., 10 to 25 ma., and 50 cm. focal skin distance. The intensity varied from about 10 to 40 roentgen units per minute. A total dose of 600 roentgens was applied in two or three treatments following one-day or two-day intervals.

The spermatocele slowly decreased in size and usually disappeared in about eight weeks. Aspiration of fluid forty-seven and fifty-one days after treatment showed most of the sperms to be immotile, with many isolated heads and tails. Four patients were found to need a second course of treatment, but none needed a third course. The final state of the patient revealed a collapsed sac without fluid, the walls of which could be rubbed together with a velvety feeling. The testis decreased slightly, if at all, in size, the greatest reduction being 33 per cent. No change occurred in the sexual libido or *potentia*. This treatment was given only in the cases of old men; it is contra-indicated in younger men because excision of the sac is simple and because the period of sterility from x-rays is unknown. Irradiation of the testis may result in deformed products of conception and monsters, such as may follow ovarian irradiation. LOUIS NEUWELT, M.D.

Denecke, K.: Spontaneous Restoration of the Lumen of the Vas Deferens after Resection (Spontane Wiederherstellung des Samenleiterkanals nach Resektion). *62 Tag. d. deutsch. Ges. f. Chir.* Berlin, 1938.

A case is reported in which after resection of 2 cm. of each spermatic duct, for eugenic reasons, the patient's procreative power returned. Secondary resection performed eighteen months later revealed the interesting fact that the stumps of the spermatic ducts had been drawn together again by contraction. Histological examination of serial sections showed a marked generative tendency of the duct endothelium. Individual small, newly formed canaliculi of the spermatic duct were found. Experiments performed upon dogs in this connection proved that there is a strong generative tendency of the spermatic duct. Therefore, in the resection of portions of the spermatic duct, the possibility of restoration of the duct after a certain time must be kept in mind. It is essential that the portions be at least 6 cm. long.

J. M. SALMON, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Talbot and Parlange: Osteomyelitis Due to Friedlaender's Pneumobacillus (Les ostéomyélites à pneumobacille de Friedlander). *Rev. de chir.*, Par., 1938, 57: 271.

Talbot and Parlange note that septicemia due to the Friedlaender bacillus occurs most frequently in adults; it is manifested in three forms: a pure septicemia without local manifestations, a septicemia with a single local focus, and a septicopyemia with multiple localization. The latter form is relatively rare, and the localization of the infection in a bone—an osteomyelitic focus—is very infrequent. The authors report a case in which septicopyemia resulted from an ear infection with Friedlaender's bacillus with multiple localizations. One of the lesions was an osteomyelitis of the ulna. The osteomyelitis was of the non-suppurative type, but the carious bone was removed; the lesion extended for a time, then healed spontaneously. A year later the patient was re-admitted with a recurrence of the septicopyemia with multiple localizations but no bone involvement. The primary focus was found in the nasopharynx, and cleared up under intensive local treatment. The authors find but 6 other cases of bone infection due to Friedlaender's bacillus reported in the literature, the first by Lambret, Blin, and Carlier in 1908. These cases are briefly summarized.

The 7 cases reported, including the authors' case, represent four types:

1. A periosteal infection with abscess formation (2 cases).

2. An osteomyelitis with periosteal abscess (1 case).

3. A typical extensive osteomyelitis with pus formation and large sequestra (1 case). In addition there was a case in which, not a long bone, but the petrous pyramid, was involved by an extensive suppurative osteomyelitis.

4. A non-suppurative caries of the diaphysis (2 cases, including the authors' case). In the authors' case, the bacillus was cultured from the carious bone removed at operation.

Various operative procedures in osteomyelitis due to Friedlaender's bacillus have been employed, but none have had a definite curative effect. The process has continued to progress or has regressed spontaneously (as in the authors' case) without being greatly modified by the usual operative measures. The authors used an autogenous vaccine in their case on two occasions; this vaccine caused reactions, sometimes late, but did not prevent the appearance of new lesions. Chemotherapy may prove to be the treatment of choice. In the authors' case "rubiazol" (prontosil) and a sulfanilamide derivative proved ineffective; mandelic acid was very effective in the treatment of the infection in the urinary tract (pyelonephritis). At present no really effective treatment of Friedlaender-bacillus infections is known. The primary focus of the infection is generally in the nasopharynx, and intensive local treatment of this focus is indicated, in addition to general measures to build up the powers of resistance.

ALICE M. MEYERS.

Hellner, H.: Differentiation of the Giant-Cell Tumors from Osteogenic Sarcomas (Abgrenzung der Riesenzellengeschwuelste von osteogenen Sarkomen). *62 Tag. d. deutsch. Ges. f. Chir.*, Berlin, 1938.

The especially interesting clinical problem of giant-cell tumors is of a diagnostic nature. The diagnosis of a bone tumor is possible only with an agreement of the clinical, roentgenological, and microscopic findings. There are, of course, many tumors in which the clinical and roentgenographic findings are sufficient for diagnosis, but they are usually benign. In the borderline cases, in those diagnosed with difficulty, and in almost all of the cases of malignant bone tumors a correlation of the histological findings must also follow. Without a biopsy, therefore, the diagnosis cannot be made in these cases of bone tumors. However, it is in the giant-cell tumors that it is important to note (1) that giant-cell-like sections occur in the vicinity of osteogenic sarcomas, and that sarcomas may appear as giant-cell tumors; (2) that giant-cell tumors may undergo extensive morphological changes, in which case attention is to be called particularly to the xanthomatous variations and the fibromatous and organizational processes; (3) that infected or previously surgically attacked giant-cell tumors show considerable cellular proliferations, often with distinctly atypical nuclei, many mitoses, and the disappearance of the ground substance, which may give rise to pathologico-anatomical diagnostic mistakes in that it is impossible to exclude malignancy. The microscopic findings must, therefore, be brought into correlation with the clinicoroentgenological findings.

Clinically, the following statements are true of giant-cell tumors: They occur usually during young adult life, between the ages of twenty and thirty years, in about 40 per cent of the cases. Their usual location is in the lower part of the femur and radius, as well as in the upper end of the tibia, namely, at the epiphyseal site in the long tubular bones. They produce no pain, and develop slowly. Roentgenologically, there is an eccentric, but central, involvement of an epiphysis, mostly polycystic, with a soap-bubble-like light area. Destruction of the outer wall occurs and has given rise to misinterpretations. Even perforation into the joint and rupture through the skin, though rare, has been described. In cases of giant-cell tumors the roentgenogram is never entirely reliable. On the whole, it fails in

giant-cell tumors of the small bones. A giant-cell tumor of the os calcis may look like a Ewing sarcoma or a metastasis, and of a metacarpal or metatarsal bone like a chondroma. A giant-cell tumor of the ribs may look exactly like a metastasis or a solitary myeloma, and when a giant-cell tumor is located in the spine it is not definitely demonstrable roentgenologically and the diagnosis is usually a surprise.

The diagnosis of giant-cell tumor is often impossible by purely clinical means. The roentgenogram is applicable only when there are entirely typical changes in the epiphysis of the long tubular bones. It is misleading in cases which have been operated upon, which are infected, and which are advanced. It often fails in the diagnosis of giant-cell tumors in the flat and small bones. Biopsy is usually unavoidable. There are typical sources of error in the judgment of histological partial examinations. Therefore the agreement of the clinical, roentgenological and pathologico-anatomical findings is necessary.

The question whether a giant-cell tumor may become malignant and lead to metastasis and death has caused much discussion. The clearing of the problem has failed because of the fact that it was not known that osteogenic sarcomas have the same appearance as giant-cell tumors. The sarcomatous degeneration of a giant-cell tumor must be admitted; it can be demonstrated not only histologically, but often even better and earlier by clinical and roentgenological means. Often it affects older adults than those who usually present giant-cell tumors. The tumor that was previously considered as circumscribed and as benign suddenly becomes rapidly larger. There is impairment of the general health. Often there is a complaint of pain. The roentgenogram shows a considerable destruction, dissolution of neighboring portions of the bone, and the disappearance of the curd-like residue in the interior of the tumor. If such a behavior, which no longer responds to the picture of the benign giant-cell tumor, is demonstrable clinically and roentgenologically, and if the biopsy shows the predominance of a spindle-celled atypical tissue with disappearance of the giant-cells and also a decrease in the number of nuclei and atypical giant cells, the presence of a sarcoma on the base of a giant-cell tumor is certain. However, viewed as a whole, this outcome is rare, and these observations, of which there are at least a dozen in the literature, do not change the fact that the majority of giant-cell tumors should be considered prognostically favorable. The sarcomatous degeneration of benign, typical giant-cell tumors is found in association with advanced age, repeated interventions, infection, irradiation, and a hereditary familial predisposition to the blastoma.

(Hellner). Louis Neuwelt, M.D.

Waldenström, H.: The First Stages of Coxa Plana. *J. Bone & Joint Surg.*, 1938, 20: 559.

Coxa plana means flat epiphysis. The etiology of this disease is still unknown. This condition is also known as Legg's disease, Calvé's disease, Perthes' disease, and osteochondritis deformans.

Fig. 1-A.

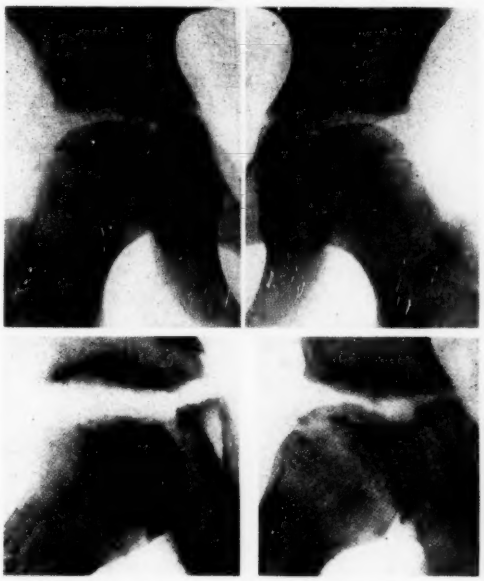


Fig. 1-B. Fig. 1-C.

A boy, aged nine years, was admitted to the hospital on September 6, 1932, with a slight limp of three months' duration.

Fig. 1-A: Roentgenogram, taken on admission, showing the epiphysis of the right femur to be lower than that of the left and flattened on its upper portion, as well as an increase in the distance between the epiphysis and the bottom of the acetabulum.

Fig. 1-B: Lateral view (Lauenstein's position), taken on admission.

Fig. 1-C: Lateral view, taken one year later.

A study of anatomical specimens has shown that the pathological process is a primary necrosis followed by resorption of the necrotic cancellous tissue, and lastly a formation of new bone and cartilage. This paper is based on studies made of patients treated personally by the author during the past thirty years.

The first symptom of coxa plana is a limp, sometimes associated with pain in the hip, or more commonly, in the region of the knee. There is also a restriction of the mobility sufficiently definite to be measured when compared with that of normal hips.

The roentgenographic appearance of the two hip joints when taken in the anteroposterior direction only, usually does not show the early changes. However, when roentgenograms are taken by lateral projection (with the femur in flexion and abduction) the deformity is more pronounced. Two or three

Fig. 2-A.

Fig. 2-B.

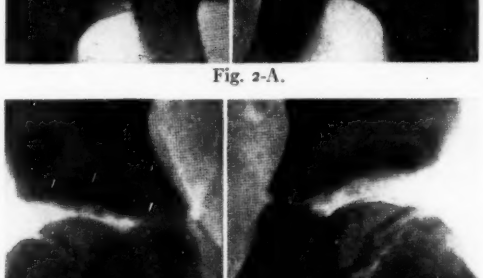


Fig. 2-C.

A boy, aged seven years, was admitted to the hospital in January 1936, with a very slight limp of six weeks' duration.

Fig. 2-A: Anteroposterior view on admission.

Fig. 2-B: Lateral view on admission.

Fig. 2-C: Anteroposterior view one year later.

months after the onset of the limp, the characteristic signs of coxa plana begin to be visible, that is, the normal structure of the cancellous tissue in the upper part of the epiphysis on the articular surface begins to be resorbed. The changes in the roentgenograms taken at this early stage are very slight, and a minute comparison of the two hip joints is required to discover them.

In these minute roentgenographic studies, the form of the two sockets is identical. In comparison of the femoral epiphyses, the epiphysis on the involved side is found to be lower and shows a distinct flattening of the part facing the roof of the acetabulum. In the roentgenograms taken with the femur in flexion and abduction, the flattening is still more apparent. Flattening mainly involves the upper anterior part, whereas the lower portion retains its normal shape. The necrosis is never limited to the lower part of the epiphysis.

Examination of the roentgenograms of these early cases of coxa plana shows a constant change in the diseased hip joint, consisting of an increase in the distance between the femoral epiphysis and the bottom of the acetabulum (Figs. 1-A, 1-B, and 1-C).

Coxa plana has been found to arise in a primarily normal joint. In the matter of treatment, the author warns against any radical operative procedure. If anything is to be done, it should be done before the stage in which extensive necrosis of the epiphysis and sometimes of the adjacent portion of the neck occurs. It should be remembered that most cases heal with a deformity which is only slightly troublesome, and it is important therefore never to use any operative treatment, with the possible exception of drilling through the epiphyseal cartilage (Figs. 2-A, 2-B, and 2-C).

The most important factor is conservative treatment. From one to two months rest in bed is advocated. The patient may then be up and about on crutches for at least a year. Plaster and immobilizing bandages should never be used. All such procedures tend to impair the circulation and nutrition of the joints and may therefore be injurious.

RICHARD J. BENNETT, JR., M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Young, C. S.: An Operation for the Correction of Hammer-Toe and Claw-Toe. *J. Bone & Joint Surg.*, 1938, 30: 715.

The essential principles in the satisfactory treatment of hammer-toe and claw-toe deformities are tenotomy of the extensor tendons, lengthening of the contracted soft tissues, and arthrodesis of the proximal interphalangeal joint. The latter is performed by reshaping the head and distal end of the proximal phalanx into the form of a truncated cone and fitting this into a cavity of similar shape in the base of the second phalanx. For claw-toe deformity of the fifth toe, resection of the head and distal portion of the first phalanx is advisable.

CHESTER C. GUY, M.D.

FRACTURES AND DISLOCATIONS

Plaut, H. F.: Fracture of the Atlas in Automobile Accidents: The Value of X-Ray Views for Its Diagnosis. *J. Am. M. Ass.*, 1938, 110: 1892.

Plaut draws attention to fractures of the atlas caused by automobile accidents. These injuries are not as rare as formerly assumed. Proper diagnosis and treatment will prevent unpleasant sequelæ and are important for medicolegal reasons. After a brief description of the anatomy, the typical sites for fracture of the atlas are noted: the posterior arch

where it is weakened by the groove for the vertebral artery, and the anterior arch. Fractures of the transverse processes and in the lateral masses are the exception. The mechanism which produces these fractures consists of vertical pressure on the skull with the cervical spine fixed in a straight position; this results in the lateral masses of the atlas becoming squeezed between the occipital condyles and the axis and being displaced laterally, which bursts the atlas ring at its weak points in the posterior or anterior arches.

The clinical signs are referred to the upper cervical region, with pain chiefly in the upper neck, mainly in the nuchal groove, rigidity, and impairment, particularly of head flexion. Patients frequently support the head with their hands. In anterior arch fractures, paravertebral hemorrhage may interfere with swelling. Cord injuries are rare compared to other cervical fractures. Conclusive diagnosis is made by roentgen examination.

The author recommends that the usual roentgen views be made first, and that special views be added when necessary. If the patient can sit, a lateral view from a distance of 6 ft. is recommended. Otherwise the film is placed at the side of the neck with the patient supine and the tube pointing horizontally. The anteroposterior view through the open mouth is taken when possible. The anterior arch may be visualized by a nearly axial view similar to that used for showing the antra; the central ray is directed over the vertex, the atlas being projected in the space between the mandible and the posterior circumference of the occiput. A special view of the anterior arch is made in a postero-anterior direction with a dental film pressed against the anesthetized posterior pharyngeal wall, or in a vertical position between the molars.

Treatment consists of immobilization. Plaster casts, traction, the Thomas collar, and, rarely, operations are used. Pseudarthroses are common. The majority of the patients regain their full occupational capacity. DANIEL H. LEVINTHAL, M.D.

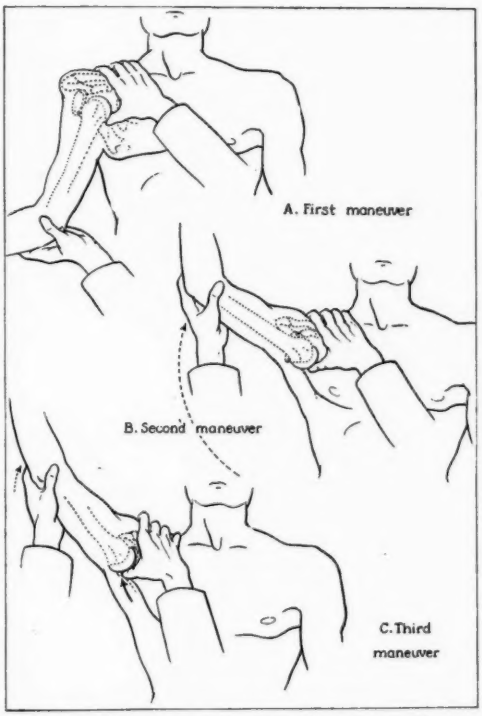


Fig. 1. *A*, First maneuver: the patient supine, the surgeon's right hand is braced against the shoulder, while the thumb fixes the humeral head; *B*, second maneuver: the patient's dislocated arm is abducted in external rotation; the thumb pressure against the humeral head is still maintained; *C*, third maneuver: with the arm in the completely abducted position, the surgeon's thumb gently pushes the humeral head over the glenoid ridge into the fossa.

Milch, H.: The Treatment of Dislocation of the Shoulder. *Surgery*, 1938, 3: 732.

The author approves of the manipulative method of Kocher which has largely superseded many other methods for the reduction of acute anterior subcoracoid dislocations of the shoulder, but cites 2 cases in which the humerus was fractured during the manipulation.

All shoulder muscles exert their forces on the dislocated and on the normally placed humeral head. It is hardly conceivable that muscles adapted to a normal position should not exert incalculable abnormal stresses in the suddenly altered relationship between the humeral head and the glenoid cavity. These abnormal stresses may make a closed reduction difficult or impossible. Many dislocations, previously irreducible, yield under general anesthesia after relaxation of the tense muscles. The resultant actions of the peripheral musculature of the shoulder depend upon the relationship existing between their individual direction and the axis of the humeral shaft. The excursion field in the glenohumeral joint is from 110 to 120 degrees. In an overhead position, all muscles assume a marked symmetry of disposition; the cross-stresses due to the oblique course of the different muscles are absent or are reduced to a minimum.

The muscles about the shoulder may be divided into three groups forming conical figures. The first group consists of the supraspinatus, the infraspinatus, the teres minor, and the subscapularis which converge on the apex of a small inner cone to form the musculotendinous cuff described by Codman. The second group is made up of the pectoralis major, the latissimus dorsi, and the teres major. The apex of this larger and more superficially situated muscular cone is located further distally on the shaft of the humerus. The third group consists of the deltoid, the

coracobrachialis, the biceps, and the triceps, which form a cone whose apex is still more distally placed. The apex of each of these muscular cones is on the humerus, and in the abducted position their axes are in general collinear with each other, with the shaft of the humerus, and with the midline of the scapula.

No traction is used in the method of reduction advised by the author. While the affected arm is being abducted into an overhead position and the shoulder is in external rotation, the head of the humerus is supported by the surgeon's thumb so that it cannot move from its dislocated position. The head rotates in the supported position and does not move downward as the arm moves upward. As a consequence, the already tense nerves are not stretched further. The external rotation releases the twisted capsule. Once the arm has been brought into complete abduction in an overhead position, all cross-stresses exerted by all muscles have been eliminated; the head can be gently pushed over the rim of the glenoid and the dislocation reduced.

This method of abduction, external rotation, and pulsion has been used with success in several cases of subcoracoid types of dislocation, in one case of supraglenoid dislocation, and in one case of fracture dislocation for which open reduction had been advised. ROBERT P. MONTGOMERY, M.D.

Meng, C. M.: The Treatment of Old Posterior Dislocation of the Elbow. *Chinese M. J.*, 1938, 53: 539.

Closed reduction of posterior elbow dislocations should not be attempted if the injury is older than ten days. After this period, contraction of the soft tissues and shortening of the triceps tendon generally necessitate open reduction. In addition, a thick mass of scar tissue forms in the space between the olecranon fossa and the incisura semilunaris, and this must be resected and the fibrous ankylosis broken up if reduction is to be accomplished.

The most satisfactory approach is by a long incision extending down the medial side of the triceps tendon to the olecranon where it is curved laterally to the head of the radius. The posterior surface of the triceps tendon is exposed, the ulnar nerve dissected out and retracted, and the triceps tendon cut transversely. The scar tissue on the posterior surface of the humerus and in the olecranon fossa is then dissected away, as well as any scar tissue about the head of the radius. The latter may have to be excised if fractured, or in order to reduce the dislocation. After reduction, the condition of the anterior aspect of the joint is investigated. This area need not be explored unless flexion is limited, in which case scar tissue should also be removed.

Arthroplasty of the joint with transplanted fascia, or resection of the lower end of the humerus will occasionally be advisable in old neglected cases in which there are complicating fractures, or in which fibrous ankylosis is extreme.

The triceps tendon is then sutured with the arm in flexion. Heavy silk is used unless the cut ends cannot be approximated, in which case fascial transplants from the thigh are taken to close the defect. A "Y" of "Z" incision in the tendon has been advocated to avoid this difficulty, but the transverse incision is preferable.

Active and passive motions are started on the tenth or twelfth postoperative day with gradual increase in motion within the limits of pain. Forcible manipulation is not advisable.

Twenty cases are reported. In 14 cases this operation was performed with excellent results in 5, good in 8, and fair in 1. Arthroplasty was done in 4 cases, with satisfactory results in 3. Resection in 2 cases gave 1 good result. CHESTER C. GUY, M.D.

Roberts, N.: Fractures of the Phalanges of the Hand and Metacarpals. *Proc. Roy. Soc. Med.*, Lond., 1938, 31: 793.

This article is based on a series of 1,200 fractures of the phalanges and metacarpals. These injuries are very common and the frequency with which malunion and stiffness of the fingers are seen indicates the importance of correct treatment.

The terminal phalanges were fractures in 100 cases and the majority of the injuries were crush fractures, often complicated by injuries of the soft tissue and the nail. Recovery depends largely on the progress of the soft tissue injury. Immobilization may be necessary for a short period if there is much swelling or infection, but every effort should be made to encourage active movements of the finger as soon as possible. Transverse fractures of the body of the terminal phalanx may be slow in uniting.

Fractures of the middle phalanx are relatively uncommon and there were only 51 cases. The fracture is through the middle of the shaft, the common deformity being one of forward angulation.

There were 286 fractures of the proximal phalanx. The typical fracture is a transverse one in some portion of the proximal half of the phalanx, where forward angulation occurs, often complicated by lateral displacement and angulation, together with a rotation deformity.

Treatment of the fractures of the proximal and middle phalanges is considered. It is very important not to treat these fractures with the finger in extension because this method often leaves some forward angulation or rotation deformity which will later impair motion. The use of traction on the finger held in the flexed position is necessary only in comminuted fractures with a tendency toward shortening. If a transverse fracture has been well reduced and splinted in a flexed position without traction, there is no tendency toward recurrence. The fingers should lie parallel in the flexed position to obviate any rotation deformity. Often, strapping the finger in a flexed position over a roll of bandage in the palm is sufficient. The finger is splinted for from two to six weeks according to the severity of the fracture and age of the patient. Movements are slow in returning, troublesome stiffness appears to be a complication, and the most that can be done

for it is to shorten the period of immobilization as much as possible.

There were 73 fractures involving the interphalangeal joints and the majority were chip fractures of the marginal joint surface complicating a sprain or dislocation of the finger. In the presence of any deformity, treatment by fixation in the flexed position, if necessary with traction, will minimize the displacement, but the prognosis is bad because painful stiffness of the affected joint is very common. Operative re-position may improve the roentgen picture but the results are disappointing. If after splintage and later active exercise there is no sign of improvement of the movements, then an early decision should be made as to whether amputation is advisable.

There were 185 fractures of the first metacarpal and of these 93 per cent were fractures of the base. There were 73 cases of Bennett's fracture, an outward subluxation of the base of the metacarpal with a triangular or comminuted fracture of the "beak" which remains in its normal position at the base. It is essential in this fracture to maintain a position of extreme abduction and extension of the thumb. Malunion of these fractures results in severe osteoarthritis with disability. An easily applied method of treatment is to construct a wire frame in the manner of a Thomas splint and to incorporate this in a dorsal plaster cast which fixes the wrist joint. Traction is then made on the thumb and local pressure is applied over the base of the metacarpal by means of a felt pad. The period of fixation should be about six weeks.

There were 100 cases of fracture of the base of the thumb metacarpal not involving the joint. The untreated cases often heal with a backward angulation which may limit the abduction movements of the thumb. Early cases should be reduced under anesthesia and the position maintained by a dorsal plaster cast incorporating the thumb as far as the interphalangeal joint. The thumb is held in a position of abduction and extension. Fixation should last about four weeks.

There were 516 fractures of the other metacarpals. Fracture of the neck of the fifth metacarpal is very common and the deformity is one of posterior angulation with lateral deviation to one side or the other. Correction of the deformity in recent cases is easily accomplished but the position must be held by a dorsal plaster cast including the proximal phalanx of the affected finger. Traction is of no value.

Fractures of the shaft of the metacarpals most commonly involve the fourth and fifth. The deformity is usually only slight and is in the nature of shortening without much angular deformity. Errors in treatment are most commonly due to oversplintage or use of traction for a slight degree of shortening. In the ordinary case of fracture of the metacarpal, natural recovery proceeds quickly and functional disability of the hand is rarely seen. All that is necessary in the oblique fracture is a dorsal plaster cast and early institution of finger movements. If there is angular deformity this is corrected by manipulation and by moulding the plaster closely over the dorsal surface of the injured metacarpal. The plaster may include the proximal phalanx of the injured finger. Finger movements should be encouraged to be full within a day or two and the patient will be ready for work in about four weeks.

HARVEY S. ALLEN, M.D.

Mallet-Guy, P.: Closed Reduction of Fractures of the Spine (Documents sur le traitement non sanglant des fractures du rachis). *Lyon chir.*, 1938, 35: 257.

Mallet-Guy reports a follow-up study of 21 cases of fracture of the spine in which closed reduction was done by Boehler's method, first reported in 1936; and 15 new cases were treated and followed up since May, 1936.

In the first group there were 3 patients with fracture complicated by paraplegia; 2 of these patients have since died; in both the spinal-cord lesion was irreparable. There has been marked improvement in the condition of the third patient, with only a slight residual paralysis. Of 10 patients with recent fracture without paraplegia, the author has recently examined 8, and all but one of them are working without disability or pain. One still complains of pain and disability which is not, however, localized at the site of the fracture; the roentgenogram shows an excellent anatomical result. Of the other 2 patients, one reports an excellent result; the other complains of some pain, but the question of compensation is not settled in this case. In 5 patients in whom reduction of the fracture was not done till late, the follow-up study showed all of them to be working without functional disability; 3 occasionally have slight pain, but it does not interfere with their usual activities.

The 15 new cases most recently treated by the author include 2 cases of fracture with paraplegia, 9 cases of recent fracture of the thoracolumbar vertebræ; 1 case of old fracture in the thoracic region; and 3 cases of fracture of the cervical spine. These cases were treated by the author's method of closed reduction described in detail before the Société de Chirurgie de Lyon on May 27, 1937. In one of the cases of paraplegia, the symptoms persist; in the other, the paraplegia has entirely disappeared, the sphincter function is normal, and there is only a slight zone of perineal anesthesia. In the 9 cases of recent fracture in the thoracolumbar region, the results are good; all of the patients are practically free from symptoms and serious disability; most of them are working at their occupations. In the case of late fracture the result was also good; the patient has no pain, although pain was constant and often severe before reduction. Of the 3 cases of fracture of the cervical vertebræ, 1 with paralyses of the right brachial plexus is showing progressive improvement, a year and a half after the injury. In the 2 other cases the functional results are excellent and

there is no persistent pain; one patient has occasional pain in turning the head quickly, the other a dysesthesia of the right index finger.

The functional results have therefore been very satisfactory in this series in the fractures which were treated within the first fifteen days. In these cases the roentgenological examination usually showed a good anatomical result; if the repair of the fracture was not perfect, as could be demonstrated in some instances by placing the patient in the position of lordosis, the enlargement of the neighboring vertebral discs practically corrected this and maintained the normal axis of the spine. In fractures treated one month or more after injury, the functional results were often good, but the fractured vertebræ showed definite anatomical abnormalities, and the normal axis of the spine was maintained by the support of the neighboring vertebræ. ALICE M. MEYERS.

Watson-Jones, R.: Dislocations and Fracture-Dislocations of the Pelvis. *Brit. J. Surg.*, 1938, 25: 773.

Isolated fractures of the pelvic ring include fracture of the body of the ilium, unilateral fracture of one or both pubic rami, and slight separation of the symphysis pubis. Wide displacement of the fragments does not occur. These fractures are treated by recumbency; and the patient may lie in any position desired.

Combined fractures of the pubic segment of the pelvic ring may be unilateral fractures of the pubic rami with dislocation of the symphysis or bilateral fractures of both pubic rami. They are produced by lateral compression of the pelvis. There cannot be marked displacement of the fragments, alteration of the alignment of any weight-bearing joint, or shortening of the lower extremities. The treatment is recumbency for from four to six weeks with the patient lying on his back. Lying on either side will increase the lateral compression.

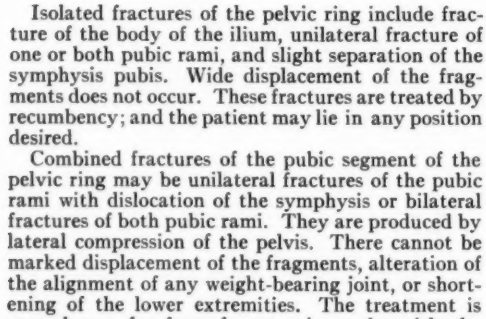


Fig. 1. The dislocated ilium is rotated forward and downward toward the uninjured side.

Combined fractures of the iliac and pubic segments of the pelvic ring may result in wide separation of the fragments, complete disruption of the pelvic rim, deformity, and shortening. The common examples are dislocation of the symphysis with sacro-iliac dislocation, and fracture of both pubic rami with sacro-iliac dislocation. These injuries are produced by forceful compression in the anteroposterior axis. The displacement is most easily corrected by manipulation under general anesthesia with the patient lying on the uninjured side. The reduction is maintained by a double short-leg plaster hip spica. If the cast becomes loose a second plaster spica is applied in a similar manner. Immobilization is continued for three months. The patient should lie on either side and not on his back. Periodic roentgenograms should be taken. The functional result depends upon accuracy of reduction of the sacro-iliac dislocation, which is easily overlooked.

The displaced innominate bone is rotated on a longitudinal axis near the sacro-iliac joint. The dislocated half of the pelvis is swung outward, and only secondarily, in the more severe cases, is it displaced upward. The weight of the lower extremity maintains the outward rotation. Any manipulative maneuver done with the patient lying on his back is made more difficult because gravity tends to keep the fragments rotated outward. Lay the patient on the uninjured side and the two halves of the pelvis fall together. In many cases the reduction is accomplished by the time the patient is in this position. It may be necessary to apply pressure over the crest of the dislocated ilium, and push and rotate it downward and forward toward the normal half of the pelvis. When the pelvic disruption is complicated by rupture of the urethra, extravasation of urine, or injury to the pelvic viscera, which interferes with active treatment of the bone and joint injury, simple lateral recumbency is the treatment recommended.

Eleven of the 18 patients with total disruption of the pelvis were treated by manipulation and plaster in lateral recumbency. There was 1 death; all the other patients made uneventful recoveries.

Six patients had old unreduced injuries. The striking feature of these cases was the constant complaint of aching pain in the sacro-iliac region when this joint was involved, and the absence of symptoms other than shortening of the leg when the joint was uninjured. ROBERT P. MONTGOMERY, M.D.

Putti, V.: The Treatment of Fractures of the Neck of the Femur (Indirizzo e metodica nella cura delle fratture del collo del femore). *Chir. d. organi di movimento*, 1938, 23: 399.

The treatment of fractures of the neck of the femur is placed under two headings: (1) recent fractures, and (2) old fractures.

A total of 698 cases of recent fracture has been treated at the Istituto Rizzoli from its foundation to 1937. Five hundred and twenty-nine cases, or 75.78 per cent, were treated by the closed method. One hundred and sixty-nine cases, or 24.22 per cent,

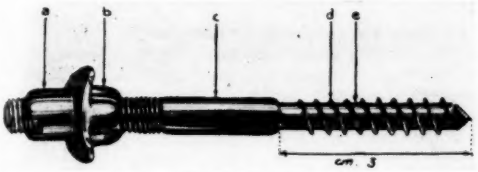


Fig. 1. The Putti screw-bolt.

were treated by open operation. The operative interventions were as follows:

Removal of the head—7 cases
Whitman reconstruction operation—2 cases
Transtrochanteric osteotomy—2 cases
Osteosynthesis with arthrotomy—8 cases
Blind pegging by transtrochanteric osteosynthesis—114 cases
Autogenous transplantation—5 cases
Osteosynthesis using stainless steel bolts—34 cases

In 3 cases there was more than one operation performed.

Putti uses a portable roentgen machine with two sets of tubes, one for the anterior position and the other for the lateral. These are adjusted before the operation begins. Repeated films can be taken without disturbance of the patient or moving of the machine during the operation.

A small developing tank which only requires the insertion of the hands is used in the operating room. In this manner the films can be rapidly developed and the course of the drill can be very carefully checked.

A heavy threaded screw bolt with a large nut is used to fix the fragments firmly together, and any possible slipping of the fragments is thereby avoided, and at the same time the fragments are firmly drawn together on the same principle as the nut and bolt used by mechanics.

Operation is advocated as soon as possible following the fracture, provided that the patient's condition permits it. Pre-operatively, the patient is placed in traction with abduction of 30 degrees and internal rotation. From 8 to 10 lbs. of weight are required. The fracture is reduced prior to the operation.

The injured leg is placed on the operating table with 20 degrees flexion of the hip, abduction of 10 degrees with internal rotation, and flexion of 10 degrees.

A metal grid is placed over the hip and a film is exposed. The center of the head can be well localized. A colored dot is placed on the skin where the grid marks the center of the head, then the grid is removed.

From 30 to 40 c.cm. of 0.5-per-cent novocaine are used.

The Valls-Lagomarsino guide is now inserted into the center of the head and a check-up film is taken. Any adjustments which are necessary are made.

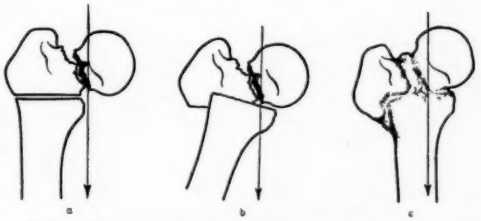


Fig. 2. The three steps of an intertrochanteric osteotomy.

An incision 10 cm. in length is then made over the trochanteric prominence and the bone is reached.

The size of the bolt to be used is determined by the number indicated on the guide.

A small drill hole is made all the way through, then a larger hole is made in the trochanteric fragment alone, so that the screw bolt slips through the proximal fragment without any effort.

The screw bolt is inserted until the head fragment is firmly fixed, then the nut is turned and the two fragments are pulled together.

The operative time is between twenty-five and thirty-five minutes.

Postoperatively, a cast which includes the pelvis and extends down to the knee on the affected side is applied. The patient is permitted to get up at the end of three or four weeks. The cast is bivalved at this time and physical therapy is started. No attempt at weight-bearing is permitted for at least two months after the operation, and then only gradually, with external support. The cast is taken off when union is shown roentgenographically.

The mortality was 12.1 per cent, there being four deaths. In 68 per cent of the cases there were excellent end-results, in 20 per cent, good results, and in 12 per cent, failures.

For old ununited fractures of the neck of the femur, the author advises an intertrochanteric osteotomy, and that the distal fragment be forced medially under the head with some abduction of the leg. This should be done under local anesthesia through a small lateral incision.

The leg must be kept in traction for at least a week prior to the operation in order that the shaft be pulled down so that when the osteotomy is done it will be below the level of the head and not above it.

The osteotomy must be done with care and precision, the cut being transverse to the long axis of the shaft.

This usually requires from fifteen to twenty minutes. The patient is placed in a cast including the pelvis and extending to the malleoli, with about 50 degrees of abduction and slight flexion of the hip and knee. This cast remains on from two to three months until some callus is evident around the osteotomy. Then the leg is brought into 30 degrees of abduction and a similar cast is applied. Immobilization is necessary for four or five months from the

time of operation. Twenty-one operations have been done with 19 successful results.

The value of the article is enhanced by beautiful and instructive illustrations. CARLO SCUDERI, M.D.

Goff, C. W.: Fresh Fracture of the Os Calcis. *Arch. Surg.*, 1938, 36: 744.

An excellent historical review of the literature dating back to the year 1720 is included in this article, and the illustrations present concisely the various methods of treating fractures of the os calcis since the year 1905.

The author treated 8 patients with fresh fracture of the os calcis by immediate reduction under gas-oxygen anesthesia. This was accomplished by the use of a modified carpenter's clamp to which could be adapted wooden blocks of several sizes and shapes to aid in molding the fractured fragments back into their normal position. In this manner the lateral expansion of the fractured fragments was cared for.

In cases of avulsion of the upper tuberosity in which a fragment is pulled upward by the Achilles tendon along with plantar displacement of other fragments, the bones are molded forcibly into position by application of the clamp at right angles to the first position described (Fig. 2). After the displaced fragments are forced into position, felt padding is then applied to the sole extending around the heel and up to the knee. A snugly fitting plaster cast is then adjusted from the toes to the upper part of the thigh, the knee being slightly flexed and the foot in the position of slight talipes equinus. A walking iron is incorporated. At the end of the second week the encasement is cut away above the knee. The plaster is removed at the end of the tenth week and physical therapy is begun. Weight bearing is allowed at the end of the twelfth week. A longitudinal arch support made of firm felt or metal is used in the shoe.

The author's cases are explained in detail along with tracings made from the roentgenograms of the fractures with lines drawn to illustrate the variety of tuber joint angles encountered.

The results of this treatment showed that 6 of the 8 patients made comparatively rapid recovery. This method is simple, effective, and comfortable for the patient and removes the necessity of tenotomy. The more severe the fracture the more likely is spontaneous arthrodesis to occur and the more excellent the result if the reduction is complete. Old painful fractures call for a double or triple arthrodesis and occasional tenotomy may be necessary. An astragalectomy is never indicated. A restoration of the tuber ankle joint angle is essential. Closed reduction of a fresh fracture by forceful molding is recommended. The more recent writers report shorter periods of disability. Eight cases are reported in which closed forceful molding by means of a clamp and blocks was used RICHARD J. BENNETT, JR., M.D.

Irwin, C. G.: Fractures of the Metatarsals. *Proc. Roy. Soc. Med.*, Lond., 1938, 31: 789.

A series of 54 recent cases of fractured metatarsals is reviewed. The metatarsals are fractured by either direct or indirect trauma, the most common form of injury resulting from the dropping of some article on the foot or the mashing of the foot by the wheel of a vehicle. The indirect type, which largely concerns the base of the fifth metatarsal, is caused by a twist of the ankle or a shoe that is caught which causes the patient to fall forward and crack through the second and third metatarsals at their necks.

In the great majority of cases no reduction is necessary as the alignment is usually maintained. Many cases are difficult to diagnose even with the aid of the roentgen rays, but the author stresses the importance of proper care of even a small crack of the metatarsal as neglect may lead to several months of difficult walking.

If the first metatarsal is fractured great care must be taken (1) to correct any impaction, and (2) to be

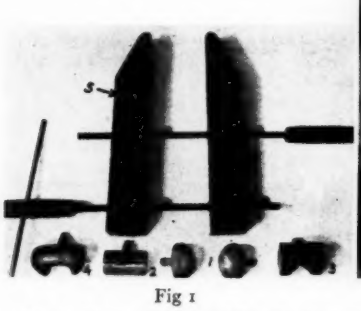


Fig 1

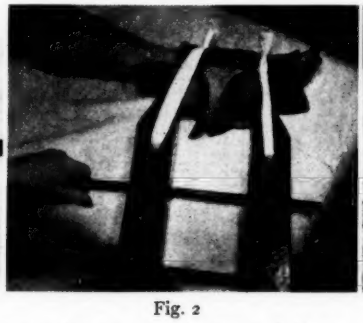


Fig. 2

Fig. 3

Fig. 1. Clamp used in molding the fragments and reducing the fracture: *1*, hemispherical blocks for lateral modeling; *2*, oblong block used against plantar surface; *3*, grooved block to fit around the attachment of the Achilles tendon over the tuberosity; *4*, semilunar block used beneath the lateral malleolus, and *5*, holes through the jaws to carry muslin ties to hold the clamp to the foot. Fig. 2. The position in which blocks *2* and *3* are used to bring down the posterior tuberosity and raise the head of the os calcis. The clamp cannot get away from the foot because of the muslin ties. Fig. 3. Application of the walking cast; manner of padding beneath the walking iron.

certain that any angulation shall not project toward the sole. Either of these complications would produce weight distribution on to the second or third metatarsal with serious complications to the transverse arch and mid-tarsal region. There is rarely much deformity when the middle metatarsals are fractured obliquely, and the first and fifth remain intact.

In the severe direct-violence injuries all the bones may be fractured. Early reduction is important. Attempts at manual reduction in these cases is usually futile and merely produces an increase of the damage to the soft parts. For these cases the author uses a general anesthetic. Wires are passed through the tips of the toes and traction is maintained against counter-traction at the ankle. Reduction of the fracture may be checked with the roentgen-rays and with the traction maintained the plaster cast is applied and carefully moulded to the arch of the foot. If there is a tendency for the displacement to recur an extension is added to the plaster and the wires are tied to it. The cast extends from below the head of the metatarsals to below the knee. As the swelling subsides the foot is replastered.

In simple cases the patient is encouraged to walk immediately. The author stresses the value of the walking-plaster as it produces the quickest result both in the healing of the bone and the maintenance of muscular and vascular tone.

The cast should be retained, even in simple crack fractures, for a month, and in more complicated cases from five to six weeks. After removal of the cast the patient is fitted with a transverse metatarsal strap and pad, while the inner side of the sole and the heel of the shoe are raised ¼ in.

In the 54 cases the average period that the patients were away from work on account of a fracture due to indirect violence was eight and one-half weeks, and on account of a fracture due to direct violence, thirteen weeks. HARVEY S. ALLEN, M.D

ORTHOPEDICS IN GENERAL

Cretin and Pouyanne: Action of a Graft of Elastic Tissue in Contact with Partially Resected Bone (L'action d'une greffe de tissu élastique au contact d'une résection osseuse partielle). *Mém. l'Acad. de chir.*, Par., 1938, 64: 709.

Cretin and Pouyanne report an experiment in which a portion of the radius of a dog was resected, after the periosteum was stripped off. A segment of an artery with the endothelium removed was washed in physiological saline solution and inserted in the place of the resected bone; the periosteum was replaced over the arterial graft and sutured. In forty-five days the bone was found to be almost completely regenerated; only a thin layer of connective tissue and cartilage separated the advancing bony growth.

Examination of sections showed that the periosteum was very active; there was no trace of newly formed bone between it and the arterial graft. The elastic coat (tunica media) of the artery had undergone a definite transformation, first into cartilage, then into osteoid tissue and bone, where some of the elastic tissue elements were still discernible. The authors point out that the structure of the elastic coat of an artery is analogous to that of the periosteum. The periosteum contains elastic tissue elements, but these are minimal as compared with those of the tunica media of the artery. The mineral elements, calcium and phosphorus, pass through the periosteum, or its homologous structure, the artery, to be deposited in the pre-osseous tissue for the formation of bone. ALICE M. MEYERS.

THE PRESENT STATUS OF THE MANAGEMENT OF VARICOSE VEINS

Collective Review

HERMAN O. McPHEETERS, M.D., F.A.C.S., Minneapolis, Minnesota

ANY thesis on the management of varicose veins must of necessity discuss the development and evolution of that treatment as a proper background. This has been done so thoroughly and so often the past few years that I will make this review as brief as possible.

Early medical literature clearly proves that varicose veins were recognized as abnormal, and as early as the first century they were thought to be the cause of ulcerations of the lower legs and feet. The efforts then as now were to dispose of the varicose veins. The first attempts were along surgical lines. The veins were transfixed (19) with stilets and sutures. Some workers used the hot cautery iron. The first recorded efforts at suture and tying off of the veins were by Celsus (44) who tied off the vein above an ulcer. Pare (44) did this again in 1579. Brodie (5) in 1846 very clearly understood the reverse flow in varicose veins and urged ligation of these veins, but for some reason his theories and ideas were not accepted for it was left to Trendelenburg (58) in 1891 to imprint and associate his name with the tests and operation for their cure. Other prominent names associated with the development of this treatment are Schede (47), with his multiple division, Keller (25), with his wire stripping; and Mayo (33) and Babcock (1) with their strippers. It was Schiassi (48) in 1908 and Homans (21, 22) in 1916 who first advocated the ligation of the saphenous vein at the saphenofemoral junction. It was from this time that real progress was made in the treatment of varicose veins.

Coincident with the development of the surgical treatment of varicose veins there were attempts by others to cure the condition by the injection of solutions directly into the vein lumen. The exact cause and method of obliteration was not known although the veins did thrombose and disappear in many cases.

The modern treatment of varicose veins is based on the results of both the operative and the injection treatments, and today the combined high ligation and injection treatment is used by most surgeons in all cases of extensive varicose veins of the lower extremities.

Schiassi (48) in 1908 was the first to use the combined treatment. He was the first to inject the solution into the distal segment at the time of ligation. Some say Tavel (55) did the same in 1904, but I believe he injected his solution at a later date.

Because the injection treatment alone is sufficient for all the smaller veins and is preferred by some for all varicose veins, large and small, it is best that it be discussed first.

There are still a great variety of solutions used for this work and none as yet has been found that complies with all the requirements of the perfect solution. There is the occasional worker here and there who still prefers the 20 per cent salt solution, while some prefer the salt and sugar mixtures. Sodium salicylate has been forgotten although the French still use it to some extent. Quinine is still used a great deal in England; but it is not used as much in the United States as it was. Verovitz (59) thinks that the combination of quinine and sodium morrhuate is the ideal solution. Stapelmohr (52) uses a 65 per cent dextrose solution, although the majority of workers have given up the sugar preparations. Sodium morrhuate is used today by more physicians than any other solution. It is now prepared by all the pharmaceutical houses in the standard strengths of 5 and 10 per cent. The reactions seem to vary somewhat but are quite constant. Many cases of allergic reactions have been reported following its use. Some, I feel sure, were not anaphylactic but merely the psychic reaction so often seen in some patients. One fatality was reported in the *Journal of The American Medical Association*, 1937, 108: 1822, under Notes and Queries. The author was not given. Glick (15), Traub (57), Dale (6), McCastor (34), and Lewis (31) have all reported allergic responses, and some have seemed to observe them quite often. These reactions are undoubtedly due to impurities in the product which perhaps has been made from an inferior grade of oil. They all seemed to have occurred following

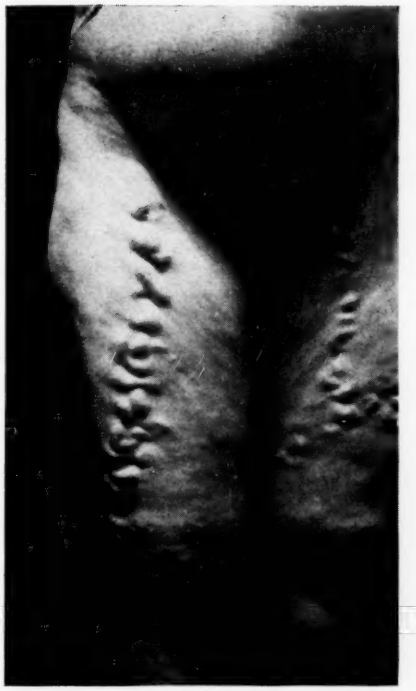


Fig. 1. Before treatment by ligation and injection.

Fig. 2. Three months following ligation and injection treatment.

an injection performed after some period of time had elapsed since the previous injection. This I believe is over-exaggerated as I have used sodium morrhuate in several thousand injections over a period of several years and have never seen any serious reaction other than the urticaria. This urticaria has not occurred during the past two years. I never make any effort to test my patients for allergic response, whether they have been treated before or not, and use the dose suitable and indicated for the individual and varix being treated. Many of the reported cases were over-treated, in my opinion, with entirely too large doses into one varix in the calf. I still use the tourniquets in an effort to localize the injected solution and it may be that they retard the rate of absorption and thus minimize the allergic response. Sodium ricinoleate is very effective and preferred by many, and a new preparation of monolate is giving fine results. Sodium linsoleate is good and would seem to be free from the possibility of allergic reaction.

In the majority of cases in which the great saphenous vein at the foramen ovale is size 3 or larger, there will be a recurrence of the varicose vein due to recanalization. It is for this reason that the combined high ligation and injection treatment has become accepted today as the proper method of treatment of any extensive case of varicose veins with a marked reverse flow (Figs. 1 and 2). This combined method is used by such an array of workers as Haggard (16), Lahey (54), Ochsner (41), Zimmerman (62), Johnson, G. S. (23), Johnston, C. H. (24), Hawkes (17), Lowenberg (32), Willauer (61), Swinton (54), Edwards (9), Faxon (13), and the writer. Kilbourne (27) disagreed and said that "history has proven it a failure the same as with other surgery for varicose veins." He used the injection treatment alone. In the entire American literature I have been unable to find a record of a single fatality following the combined ligation and injection treatment although Westerborn from Sweden reports a mortality of 0.33 per cent in 1,200 cases treated in this way. This is hard to explain except that his patients may have been kept in bed for some time after the operation, while we, in this country, have the patient get off the operating table and

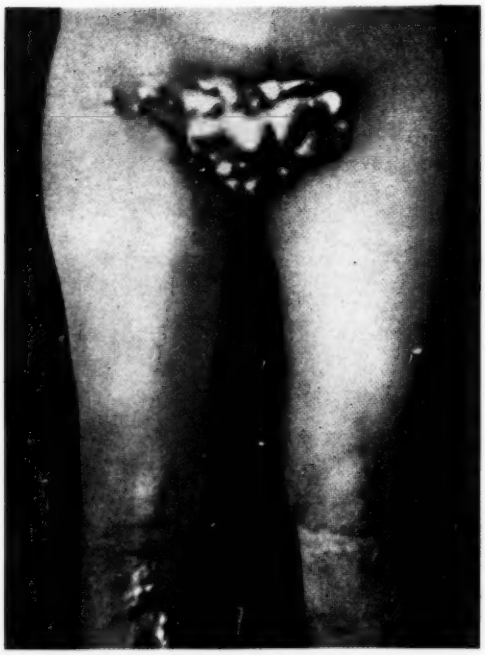


Fig. 3. Extensive varicose veins of the labia seen at the eighth month of gestation. These can be easily treated with the relief of much pain and discomfort when seen about the fifth month. (Courtesy of Dr. C. R. Wall, Minneapolis, Minn.)

walk. Personally, I have my patients up and walking every two hours. In no case have I ever had a sign that might point to a pulmonary embolus.

Some workers prefer to ligate *only* at the time of the operation (17), while others go to the other extreme and do a bilateral ligation with injection of both distal segments at the same time. The ligation is distinctly a surgical procedure and should be done only in the operating room, as any surgery. Any of the solutions may be and are used for the injection with the ligation. Some workers prefer to wait one week after the ligation before they make any injections. This is entirely a matter of personal judgment.

When there are complications in the lower leg, as ulcers and eczemas, secondary to the presence of the varicose veins, most workers prefer to use the supportive therapy until the case is under control and then ligate and inject the solution as in any other case. With this I fully agree. Sarma (46) advises that the ulcer be healed before ligation is done. He says he has often had a thrombus form in the proximal segment. If the ligation was done at the saphenofemoral junction there would be no proximal segment left; therefore he has ligated too low. The early ligation will hasten the healing of the ulcer. Owens (43) urges that excision of the dense scar tissue of the old recurrent ulcer area be followed immediately by the application of a pedicled flap or a full-thickness skin graft. He has much evidence and experience to confirm his opinion. Faxon (13) advises the undercutting of the ulcer area with excision and skin grafting. In other cases he suggests a wide undercutting so that any bed of veins under the ulcer may be broken up, and then that the area be sewed back again as a true skin flap. Stapelmohr (52) excises the ulcer and scar area and then applies a Thiersch graft. Douglas (7, 8) advises excision of the ulcer and scar area and the immediate application of his sieve grafts. Personally I believe we should excise far more areas of recurrent ulcerations and scar tissue about the lower leg than we do, for new skin well grafted on a good bed will stand much more trauma than the paper-like covering over a healed ulcer. Stern (53) uses a 5 per cent alcoholic solution of gentian violet which he applies over the ulcer three times a day. This he follows with a drying dusting powder. Thurmon (56) uses pure gentian violet crystals in a 2 per cent aqueous solution. This is also applied three times a day and left uncovered to dry. Some think the ultraviolet light is of much help. Eidinow (12) uses it for both varicose ulcers and eczemas. During the past two years much has been done with the use of iontophoresis in the treatment of varicose ulcers. Kovacs (28, 29) and Murphy (38) have reported ideal results.

The fungus infection associated with the secondary extensive weeping eczema and dermatitis so often seen with ringworm infection of the feet is markedly aggravated by the presence of large varicose veins. The latter should be treated just the same as in any other case. Rusten believes that most of the skin reaction is allergic in nature and secondary to products formed and liberated in the original infected area. The best results are obtained when the patient is put to bed with the lower leg in high elevation and in packs saturated with Burrows solution diluted 1 to 10 with cool water. Small amounts should be applied every half hour so as to keep the few layers of gauze continually wet. The application of a 5 per cent alcoholic solution of gentian violet or any good antiseptic over the area of the active course of the fungus is correct and should be done twice a day. After the weeping has stopped, applications of zinc oxide and olive oil are commonly used over

Fig. 4. Left, Extensive case of varicose veins complicating pregnancy. Patient quintipara, seven months pregnant. Note the extensive varices in the labia. The patient was practically an invalid from the pain in the labia and leg. Right, Same case three weeks later following treatment with 75 per cent invert sugar (Varitose). Patient was comfortable throughout the last five weeks of her pregnancy.

the recently inflamed areas. All of the patients recover more quickly if the period of bed rest is lengthened at first. Following this the patient must have support for a long time.

Infectious thrombophlebitis has received much attention the past year (36). Edwards (10) has done much experimental work on it showing the destruction of the venous valves and how this may be the first step in the development of varicose veins. The general subject has been discussed in all its phases. Most workers still use conservative treatment with hot wet packs and the leg in elevation. Others advise radical ligation proximal to the thrombus (2, 4, 22, 39).

Varicose veins often complicate pregnancy and may cause so much pain and distress that the patient is made an invalid during the last two months of the term (Fig. 3). It is true that most of these varicose veins will disappear spontaneously following confinement. Even so, many writers (33,50) advise injection for severe distress even though the condition may return when the patient is up and about (Fig. 4).

The fine, superficial bursts and spider flares (Fig. 5) can be treated by the use of ½ per cent soricin or 1 per cent sodium morrhuate. Extreme pressure should be applied immediately following treatment and the veins held collapsed by use of an elastoplast bandage over gauze compresses. This bandage should be left on for from four to six days. Of course the large varicose veins associated with and feeding the bursts must be treated with the usual solution and in the usual manner.

Fig. 5. An extensive case of superficial bursts or fine cutaneous veins. The feeder veins can be seen very clearly. A good result was obtained following preliminary high ligation and the injection of 5 c.cm. of 5-per-cent sodium morrhuate distally at the time, the lower leg being kept bandaged. The bursts of the lower leg were later injected with 1-per-cent sodium morrhuate. (Case of Dr. A. F. Bratrud.)

CONCLUSIONS

After a most thorough survey of the literature up to April 1938, I would say that the present status of the management of varicose veins can be stated as follows:

1. The injection treatment of varicose veins has been universally accepted.
2. Sodium morrhuate is used more widely than any other solution.
3. Other good and effective solutions are: monolate, soricin, sodium linsoleate, moruquin and potassium oleate. There are probably many others that I have not used.
4. The combination of high ligation and subsequent injection, either immediate or delayed, is a distinct advance in the treatment of varicose veins and their complications.
5. This treatment is a surgical procedure and must be undertaken as such.

6. The majority of workers make at least part of the injections at the time of operation through the distal segment.

7. More caution is being exercised with regard to overtreatment of the individual case, which is easily done. Not more than 1 c.cm. should be given into any varix in the lower leg at one time unless scattered injections are made.

8. More attention is being paid to the varicose veins when associated with extensive eczema and ulcerations of the lower leg.

9. More operators emphasize that the high ligation be done at the saphenofemoral junction than formerly. If the ligation is done at that point there will be no proximal segment, and therefore a proximal thrombus formation cannot take place.

10. The American surgeons make the treatment of varicose veins an ambulatory procedure and most of them have their patients up and walking immediately following the operation and injections.

BIBLIOGRAPHY

1. Babcock, W. W. New York M. J., 1907, 86: 153.
2. Bancroft, F. W. Ann. Surg., 1937, 106: 308.
3. Barber, R. F. Am. J. Surg., 1937, 36: 386.
4. Barker, N. W. Arch. Int. Med., 1936, 58: 147.
5. Brodie, Sir B. C. Lectures illustrative of various subjects in pathology and surgery. London: Longman, Brown, Green, and Longman, 1846.
6. Dale, M. L. J. Am. M. Ass., 1937, 108: 718.
7. Douglas, B. Surg., Gynec. & Obst., 1930, 50: 1018.
8. Ibid., 1935, 61: 458.
9. Edwards, E. A. Surg., Gynec. & Obst., 1934, 59: 916.
10. Ibid., 1937, 65: 310.
11. Ibid., 1938, 66: 236.
12. Eidinow, A. Brit. M. J., 1937, 1: 16.
13. Faxon, H. H. New England J. M., 1937, 216: 327.
14. Fontaine, R., and Pereira, S. Rev. de chir., Par., 1937, 56: 161; (Abstr.) Internat. Abstr. Surg., 1937, 65: 347.
15. Glick, M. J. J. Am. M. Ass., 1937, 109: 300.
16. Haggard, W. D. J. Tennessee M. Ass., 1937, 30: 432.
17. Hawkes, S. H. Am. J. Surg., 1937, 36: 388.
18. Haxthausen, H. Nord. med. Tidsskr., 1936, p. 1665; (Abstr.) Internat. Abstr. Surg., 1937, 65: 57.
19. Hippocrates. Works of, translated by Francis Adams, New York, Wm. Wood & Co., 1896.
20. Holder, H. G. J. Am. M. Ass., 1937, 108: 1167.
21. Homans, J. Surg., Gynec. & Obst., 1916, 22: 143.
22. Idem. Am. J. Surg., 1937, 38: 316.
23. Johnson, G. S. Surgery, 1937, 2: 903.
24. Johnston, C. H. J. Am. M. Ass., 1937, 109: 1359.
25. Keller, W. L. New York M. J., 1905, 82: 385.
26. Idem. Ann. Surg., 1924, 79: 907.
27. Kilbourne, N. J. California & West. Med., 1937, 47: 5.
28. Kovacs, J. Arch. Phys. Therap., 1937, 18: 103.
29. Kovacs, L., Kovacs, J., Duryee, A. M., and Wright, I. J. Am. M. Ass., 1936, 107: 114.
30. Laewen, A. 61. Tag. d. deutsch. Ges. f. Chir., Berlin, 1937; (Abstr.) Internat. Abstr. Surg., 1937, 65: 348.
31. Lewis, K. M. J. Am. M. Ass., 1936, 107: 1298.
32. Lowenberg, E. L. Surgery, 1937, 2: 943.
33. Mayo, C. H. Surg., Gynec. & Obst., 1937, 65: 100.
34. McCastor, J. T. N., and McCastor, M. D. J. Am. M. Ass., 1937, 109: 1799.
35. McPheeters, H. O. J.-Lancet, 1931, 51: 587.
36. Idem. Minnesota Med., 1938, 21: 220.
37. McPheeters, H. O., and Anderson, J. K. Injection treatment of varicose veins and hemorrhoids. Philadelphia, F. A. Davis Publishing Company, 1938.
38. Murphy, H. L. Surg., Gynec. & Obst., 1937, 65: 100.
39. Neuhof, H. Ann. Surg., 1937, 106: 311.
40. Nicholson, B. B. Urol. & Cutan. Rev., 1937, 216: 327.
41. Ochsner, A. Surgery, 1937, 2: 889.
42. Orr, T. G. J. Missouri State M. Ass., 1937, 34: 219.
43. Owens, N. New Orleans M. & S. J., 1937, 89: 483.
44. Paulus Aegeneta: New Sydenham Series, 1846, 2: 406.
45. Ratschow, M. Fortschr. a.d. Geb. d. Roentgenstrahlen, 1937, 55: 253; (Abstr.) J. Am. M. Ass., 1937, 108: 1842.
46. Sarma, P. J. Surg. Clin. North Am., 1938, 18: 129.
47. Schede, M. Berl. Klin. Wchnschr., 1877, 14: 85
48. Schiassi, B. Semaine méd., 1908, 28: 601.
49. Schmier, A. A. Am. J. Surg., 1937, 36: 389.
50. Solomons, E. J. Obst. & Gynaec. Brit. Emp., 1937, 44: 650.
51. Stanley-Brown, M. Surg. Clin. North Am., 1928, 8: 1031.
52. Stapelmohr, S. von. Svensk Läkartidn., 1936, pp. 961, 1015; (Abstr.) Internat. Abstr. Surg. 1937, 65: 138.
53. Stern, E. L. New England J. M., 1937, 216: 530.
54. Swinton, N. W. Surg. Clin. North Am., 1936, 16: 1723.
55. Tavel, E. Cor.-Bl. f. schweiz. Aerzte. 1904, 34: 617.
56. Thurmon, F. M. and Chaimson, H. New England J. M., 1937, 216: 11.
57. Traub, E. F. New York State J. M., 1937, 37: 1506.
58. Trendelenburg, F. Berl. klin. Wchnschr., 1877, 14: 85.
59. Verovitz, C. H. Ohio State M. J., 1938, 34: 37.
60. Westerborn, A. Acta chirurg. Scand., 1937, 79: 321; (Abstr.) Internat. Abstr. Surg., 1937, 65: 349.
61. Willauer, G. Surg. Clin. North Am., 1936, 16: 621.
62. Zimmerman, L. M. Illinois M. J., 1937, 71: 444.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

De Takats, G.: Vascular Accidents of the Extremities. *J. Am. M. Ass.*, 1938, 110: 1075.

Vascular accidents of the extremities are ordinarily first seen by the general practitioner, and early recognition and early simple treatment may be the deciding factors in the ultimate outcome of the emergency.

Arterial hemorrhage may be due to clean cuts or to crushing injuries of the vessels. In the latter instance large sections of the vessels may suffer from reflex spasm and this spasm may extend to the collateral vessels. Treatment of the spasm is important. In the case of medium and large-sized vessels, the bleeding cannot be controlled with simple packing, but the vessel should be doubly ligated and severed, and the stump transfixed. If the distal stump does not show pulsation, the accompanying vein should also be ligated. As soon as the injury has healed, all measures known to increase the collateral circulation must be employed. Otherwise severe contractions and atrophies ensue.

The differential diagnosis between arterial embolism and thrombosis may be very difficult. In spite of all that has been said recently of conservative measures to increase the circulation, the extraction of the clot is still the optimal treatment. To be of value this should be done within ten hours. Conservative measures should be carried out from the start. These include the use of a heat cradle, lowering of the limb from 10 to 15 degrees, and the injection of a potent vasodilator, 0.03 gm. of papaverine. If conservative measures have not been successful, embolectomy should be performed at a time when it will still be of some value. "The technic of arterial suture can be learned by anyone who can undertake to suture an injured or perforated bowel. . ."

In arterial thrombosis the conservative methods used in the case of arterial embolism should be used. In some cases the thrombosed segment keeps up a reflex spasm of the remaining vessels of the leg and should be excised.

Venous thromboses of the lower legs are divided into four groups: (1) spontaneous thrombosis of the superficial but not varicose veins (Buerger's disease frequently ensues); (2) thrombophlebitis of the varicose veins; (3) thrombophlebitis of the deep veins with typical lymphedema; and (4) thrombophlebitis of the deep perforating veins, which is frequently fatal.

In the treatment of deep thrombophlebitis, one must combat embolism, ascending thrombosis, and persistent edema. The treatment consists primarily of rest, elevation of the limb, and the application of heat. In patients with pulmonary embolism, oxygen and 0.03 gm. of papaverine should be given and if the blood pressure falls below 90 mm. Hg., its cautious elevation with ephedrin or neo-synephrin should be attempted. To prevent future persistent edema from forming, treatment should be begun early. It consists of restriction of fluid intake to 1,000 c.cm. per day, restriction of the salt intake, administration of ammonium chloride and salyrgan, and the use of the heat cradle and of elastic bandages on the limb. JOHN WILTSIE EPTON, M.D.

Tucker, J.: The Diagnosis and Treatment of Peripheral Vascular Disease. *Med. Clin. North Am.*, 1938, 22: 459.

Three main factors are responsible for most of the disturbances in the peripheral circulation: (1) excessive and prolonged vasospasm, (2) inflammation of the vessel walls, and (3) degenerative vascular changes due to the wear and tear of life.

In brief, the various agents that influence the tone of the capillaries may be classified as either vasodilators or vasoconstrictors:

1. Vasodilators.
   a. Tissue metabolites formed during muscular work, carbon dioxide and increased hydrogen-ion concentration.
   b. Tissue extracts: histamine which produces capillary paralysis and increased permeability; choline, which stimulates the vagus nerve, diminishes cardiac activity, and produces peripheral dilatation; adenylic acid which slows the heart, and effects vasodilatation.
   c. Vasodilator nerves, via the posterior roots, with centers in the posterior root ganglia.
   d. Heat, locally, which may liberate acetylcholine.
2. Vasoconstrictors.
   a. Pressor substances: adrenalin, pituitrin, and unknown physicochemical substances.
   b. The sympathetic nervous system.
   c. Cold, locally.

Both effects, whether of constriction or relaxation, are controlled through the vasomotor center. Pain, heat, cold, traumatic shock, and emotions may modify the tone of the capillaries.

In clinical practice, we must differentiate between functional and organic disturbances of the circulation. A careful history should be elicited, and a general as well as a local examination must be made.

Diagnostic measures include:

1. Inspection of the extremities: the significance of postural color changes and ulceration and gangrene are discussed.
2. Palpation: the temperature of the extremity and the presence or absence of the normal pulses must be determined. Reich has shown that, in normal people, the dorsalis pedis pulsation is absent in 4 per cent and abnormally placed in

8 per cent of all the patients. The posterior tibial artery is found to be absent in 5 per cent of all patients.

3. More elaborate methods of determining the condition of the circulation in the extremities include:
   a. Surface temperature readings by the electric thermocouple.
   b. Determination of the degree of skin vasodilatation by the histamine wheal test.
   c. The determination whether the peripheral vascular disease is due to organic vascular obstruction or, in greater or lesser degree, to vasoconstriction.
      (1) Spinal anesthesia.
      (2) Peripheral nerve block.
      (3) Increase in the internal production of heat (typhoid vaccine hyperpyrexia).
   d. Arteriography.

The author outlines in detail the points of differential diagnosis between the following organic and functional vasospastic diseases of the peripheral vascular system:

1. Organic lesions.
   a. Thrombo-angiitis obliterans.
   b. Arteriosclerotic gangrene.
   c. Arterial embolism.
   d. Latent phlebitis.
2. Functional vasospastic diseases.
   a. Raynaud's disease.
   b. Erythromelalgia (Weir Mitchell's disease)
   c. Acrocyanosis.

Under treatment, the following points are discussed:

1. Medical therapy.
   a. Specific measures.
   b. Foci of infection.
   c. Measures to avoid amputation of the affected extremity.
   d. General measures.
   e. Tissue extracts.
   f. Drugs.
      1. Alcohol.
      2. Compounds of theobromine.
      3. Papaverine.
   g. Passive vascular exercise.
2. Surgical therapy.
   a. To improve impaired circulation.
      (1) Vein ligation.
      (2) Arterial ligation.
      (3) Arterial excision.
      (4) Periarterial sympathectomy.
      (5) Sympathetic ramisection.
      (6) Sympathetic ganglionectomy.
   b. To alleviate pain.
      (1) Peripheral nerve block.
      (2) Paravertebral block.
      (3) Intraspinal alcohol.
      (4) Chordotomy (spinothalamic tracts).
   c. To remove non-viable parts, especially in arteriosclerotic and diabetic gangrene.

JOHN H. GARLOCK, M.D.

Faxon, H. H., and Barrow, D. W.: The End-Results of High Ligation and Injection in the Treatment of Varicose Veins. *Surgery*, 1938, 3: 518.

The authors give a detailed account of their mode of treatment of varicose veins, covering a report of some 367 operations in selected cases in which 1,072 extremities were treated. Their treatment of varicosities consists of high ligation and subsequent injections whenever incompetence in the valves of the main saphenous trunk in the thigh can be demonstrated. To determine the presence or absence of incompetent valves in the main trunk, the authors relied upon the findings of the Trendelenburg test and the Schwartz test as originally described by Chevrier.

The feature of utmost importance in the high ligation of the long saphenous vein is that it be carried out at the junction of the saphenous vein with the femoral vein. In their earlier cases, in which high ligation was carried out at a lower level, results proved this to be faulty operative technique. The authors point out that when in these early cases the operation had to be done a second time, the second operation proved most instructive in that it showed the extent of the collateral circulation which rapidly develops if any proximal saphenous stump is left behind at the original operation. The authors stress the importance of visualization of the anterior surface of the femoral vein at the time of operation, in order that the ligature be placed at the proper level. Almost equally important is the separate division and ligation of at least the three highest branches of the saphenous vein, together with an excision of 2 cm. of the main trunk below the ligature.

Contra-indication to this procedure is apparent only in those cases in which the superficial veins compensate for a deep circulation that has been impaired by a previous phlebitis, in those showing active inflammation in the groin, and in those in which hemolytic streptococci are demonstrable in a complicating ulcer. The authors point out that the operation of high ligation carries with it a small but definite risk of major wound sepsis (about 2 per cent) and of pulmonary emboli (about 0.3 per cent).

The operation represents but one phase, the first step, in the treatment of varicose veins. In order to obtain the best results it is essential that there be an adequate series of postoperative injections into all unthrombosed veins. These injections are made with quinine hydrochloride and urethane. Their purpose is to obliterate all unthrombosed veins.

Other adjuncts in the treatment of varicosities became apparent in the intensive study that the authors carried out. A definite, though rather small, percentage of the cases showed incompetence in the valves of the communicating branches between the deep and the superficial venous systems of sufficient degree to jeopardize the results in treatment, unless some step beyond high ligation and injection was carried out. Usually these cases gave a history of

previous deep phlebitis. Direct operative approach is the only effective method of correcting the abnormal venous flow found in grossly incompetent perforating branches This is done by securing and dividing these communicating branches.

Another relatively small group of cases showed involvement of the short saphenous system in conjunction with varicosities of the long saphenous vein. In the treatment of these cases, ligation of the short saphenous vein in the popliteal space was carried out when this main trunk was shown to have incompetent valves. The authors contend that ligation at the popliteal vein should be done on the same basis and with an observance of the same general principles that high ligation is carried out in the groin.

In order that there be complete uniformity in the evaluation of all cases, the authors secured a very careful checkup of all patients. The period of one and one-half years represents the minimal period of time since the patient's operation, while two and nine-tenths years represents the average time since high ligation. The end-result rating in 367 operations of high ligation in selected cases, carried out in conjunction with postoperative injections of varicosities, showed perfect results in 55 per cent of the cases, satisfactory results in 25 per cent, and failures in 20 per cent. The chief factors responsible for the recurrences in the group of failures were: faulty operative technique in 39 per cent; complicating incompetent communicating branches in 46 per cent; involvement of the short saphenous system in 4 per cent; and the improper selection of cases in 3 per cent.

The incidence of recurrence depends primarily on the success of the original evaluation and treatment of the cases rather than on the elapsed period from the time of treatment. Moreover, the authors point out that age, sex, the presence of bilateral varicosities, and the extent of thrombosis following operation play no significant rôle in the ultimate success or failure of treatment; also, that retrograde injection with a sclerosing solution of the distal segment of the vein at the time of operation, before the vein is tied off, makes no significant difference in the end-result rating, although it does apparently decrease the number of injections required after operation. MATHIAS J. SEIFERT, M.D.

Huet, P. A.: Tumors of the Vascular Sheaths, with Special Reference to Those of the Popliteal Vessels (Tumeurs des gaines vasculaires en particulier celles des vaisseaux poplités). *J. de chir.*, 1938, 51: 641.

Huet observed a lipoma of the sheath of the femoral vessels and 2 fibrosarcomas of the sheath of the popliteal vessels in three women, fifty-five, thirty-three, and sixty-one years of age, respectively. He also reports an observation of Hartmann concerning a forty-one-year-old man with a myxoma extending from the head of the peroneal muscle downward for a distance of about 11 cm.

In the author's 3 cases the onset dated back to four, ten, and twelve years, respectively, without causing any noteworthy symptoms. There was absence of pain, no sign of vascular compression, and no articular reaction followed although one of the fibrosarcomas weighed as much as 1,300 gm.

On histological examination the tumors presented a very complex structure. The 2 fibrosarcomas showed definite signs of malignancy. One of them had recurred within a period of five years. In spite of their malignant character, the tumors showed a definite plane of cleavage and did not invade neighboring structures.

On the basis of these findings, Huet believes that these fibrosarcomas had originated in the popliteal fossa and, more specifically, in the vascular sheath of the popliteal vessels rather than in muscle tissue.

Macroscopical examination revealed that: (1) the tumors were surrounded by a thin envelope; (2) there was no continuity with the tendons of neighboring muscles; (3) there was evidence of development within the neurovascular sheath with dissociation of its contents; (4) the tumors were anatomically related to a region normally occupied by large blood vessels; (5) they were fixed or movable according to the thickness of the sheath; and (6) there were neoplastic prolongations in the direction of the vascular bundles.

After briefly reviewing the literature on this subject, the author discusses some of the essential features of these neoplasms. Tumors of the vascular sheaths are often malignant but their malignancy is relatively limited in that they may attain a large size without invading the neighboring structures. They always seem to remain cleavable and do not produce pressure symptoms. However, in an early stage, circulatory disturbances may be observed. The tumors recur frequently. In general, it may be stated that the degree of malignancy of these tumors varies greatly from case to case.

Concerning treatment, the author believes that early amputation of the extremity is rarely indicated because these tumors do not tend to become generalized. He suggests that they be removed surgically and the patient be re-operated upon if recurrences appear. Radium therapy, applied postoperatively, yields only temporary results and is of little, if any, value in preventing recurrence.

RICHARD E. SOMMA, M.D.

BLOOD; TRANSFUSION

DeGowin, E. L.: Grave Sequelæ of Blood Transfusions; A Clinical Study of 13 Cases Occurring in 3,500 Blood Transfusions. *Ann. Int. Med.*, 1938, 2: 1777.

Renal insufficiency has long been known to occur in hemolytic blood transfusions as well as in other conditions in which hemoglobinemia occurs The various theories accounting for this reaction are not sufficient to explain the phenomenon. Not enough pathological evidence has been found in the human

kidney to warrant the belief that blocking of the tubules causes the nephritis. Chemical studies do not support the belief that the loss of chlorides has any bearing on the condition. The urticarial nature of the cause seems to be made invalid by the reproduction of the syndrome in dogs with a single transfusion. There is no experimental proof that the hemolysis releases some nephrotoxic substance. The vasoconstrictor action of hemoglobin on the kidney vessels may be a factor in producing renal ischemia, but this hypothesis has yet to be confirmed with more experimental work.

Most of these reactions, some of which have been reported elsewhere, are due to grossly incompatible blood, but some of the cases in the present series show no incompatibility of the bloods by the present laboratory methods. Hemoglobinuria does not necessarily follow hemoglobinemia; the latter must be checked by the examination of the blood serum for signs of hemolysis from one to two hours following the transfusion. Seven cases of renal insufficiency with 6 deaths are reported. In one case there was an adenocarcinoma of the cervix, in another a bleeding peptic ulcer, in a third pernicious anemia, in a fourth uterine fibroids, and in the fifth an intracranial operation, and in only 2 cases were there pre-existing kidney lesions (1 pyelonephritis and 1 chronic glomerulonephritis). The transfusions were accompanied by or immediately followed by a febrile reaction, some by chills, cyanosis, and dyspnea. In the ensuing days there was a gradual rise in the blood-urea nitrogen values, uric acid and creatinine, and a marked oliguria or anuria occurred. Most of the cases had a high direct or biphasic Van den Bergh reaction. Nausea and vomiting were prominent and the other common signs of uremia were usually present.

Treatment is not specific despite the many reported remedies which have benefited isolated cases. The one recovery in this series was believed to be a spontaneous one, despite the therapy rendered, rather than the result of the therapy. The one beneficial prophylactic measure suggested is the preliminary alkalinization of the urine to prevent precipitation of hemoglobin in the kidneys. This has been shown to protect the kidneys in dogs. Proof for the human being is lacking as yet.

Three cases of hemolytic reaction with an increased Van den Bergh reaction with fever were reported following transfusions in which no signs of renal insufficiency developed. In 2 of these there was no demonstrable incompatibility of the bloods. In 1 the donor was of the universal type while the recipient was of Group AB.

Two cases of pulmonary edema are reported following transfusions in which no incompatibility was shown. Both patients died within a few hours after the transfusion.

Two cases in which retinal hemorrhage occurred following transfusion are reported. One of the patients had a nephritic condition with pre-existing hemorrhage; the other had the transfusion outside of the hospital and it was not known whether the hemorrhage followed the transfusion or was present beforehand.

The author stresses the fact that the transfusion should always be stopped when any symptoms of a reaction occur. He also emphasizes the importance of carefully matching and typing the bloods before transfusion. THOMAS C. DOUGLASS, M.D.

SURGICAL TECHNIQUE

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Ives, H. R., Jr., and Hirshfeld, J. W.: The Bacterial Flora of Clean Surgical Wounds. *Ann. Surg.*, 1938, 107: 607.

A review of the literature reveals the fact that infection occurs in 5 per cent of all clean surgical wounds. Because of this the authors have made a study of the bacteriology of clean surgical wounds to determine its importance in relation to the problem of wound infections.

They took a culture of the air in the operating room during the course of operations. Cultures were taken also of: (1) the skin after its incision; (2) the region of the anterior fascia; (3) the parietal and visceral peritoneum immediately after opening of the abdomen; (4) the parietal and visceral peritoneum immediately before closure of the abdomen; (5) the anterior fascia; and (6) the line of incision of the skin.

In a part of the authors' series, cultures were taken to determine the number, rather than the type, of bacteria, and although large numbers of bacteria were found, the results obtained were disappointing.

After periods of twenty-four and forty-eight hours the cultures were examined and transplants were made, if necessary. The media used were routine meat infusions of broth and tubes of cooked meat. Solid media consisted of meat-infusion agar plates, blood agar plates, and plain meat-infusion agar. When identification by colony type was impossible or doubtful, smears from the colonies were made and stained by Gram's method.

Studies were made only of cases which were free from contamination with feces, pus, urine, or bile. Preparation of the skin consisted of several washings with sterile liquid soap and water, then with a 70 per cent solution of alcohol, and finally several coats of kalmerid were applied. Positive cultures were obtained from the skin in 86 per cent of the cases at the start of operation, and in 100 per cent of the cases at the close of operation. Cultures positive for staphylococci were noted in 80 per cent of the cases at the start, and in 100 per cent of the cases at the close of operation, which indicates that the skin is far from sterile at the beginning of the operation and is heavily contaminated at its termination.

Positive cultures were obtained from the fascia in 44 per cent of the cases at the start, and in 82 per cent of the cases at the close of operation, which indicates that the number of organisms in the wound increases and that the fascial layer is heavily contaminated.

The total number of positive cultures of the peritoneum at the start amounted to 61 per cent, and at the close, to 90 per cent.

The percentage of cultures positive for staphylococci is shown to be as follows:

Skin	at start	80 per cent
	at close	100 per cent
Fascia	at start	38 per cent
	at close	76 per cent
Peritoneum	at start	16 per cent
	at close	63 per cent

Many of the organisms come from the skin, but it is believed that the majority come from the atmosphere and fall directly into the wound, or are carried there by sponges, hands, solutions, or other material that has been exposed to the air. The results noted in the cultures which were exposed to the air of the operating room showed that the various types of staphylococci constituted the majority of organisms recovered, i.e., 88 per cent.

It is right to assume that the contamination of wounds with the staphylococcus is the cause of many postoperative infections. The authors review the subject of wound infection, including all wounds closed without drainage. During a period of three years they observed 72 infected wounds. Upon culture, 54 per cent of these yielded staphylococci alone, which figure agrees with that of other investigators who have found the staphylococci to be the cause of 50 per cent of all wound infections.

Any improvement in surgical technique which will decrease the contamination of operative wounds by bacteria from the air, or from the skin of the patient, should result in a decrease in the incidence of postoperative wound infections. HARVEY S. ALLEN, M.D.

Davis, J. S.: The Use of Relaxation Incisions When Dealing with Scars. *Pennsylvania M. J.*, 1938, 41: 565.

The author states that the relaxation incision is a very old procedure, as even Celsus mentions it in his writings. He points out the usefulness of the procedure in the treatment of old scars that are interfering with function and are therefore under tension, and states that scars cannot always be treated by the ideal method, i.e., excision.

Consideration is given to three ordinary types of scar: (1) the large, contracted, thick, adherent scar which may or may not interfere with function, and in which may be one or more unhealed areas; (2) the unstable type of scar which is difficult to heal and, when healed, frequently breaks down; (3) the contracted type of scar with binding bridles or webs.

When the author treats these scars, he prefers the patient to be in good general physical condition. He uses avertin as a basal anesthetic, supplemented by N_2O and O_2, after which he prepares the skin with ether, alcohol, and a solution of potassiomercuric iodide (4 gm. in 460 c.cm. of acetone). If a

chronic ulcer is to be excised, he swabs it thoroughly with phenol.

In the large, thick, contracted scar, which defies excision, the most binding portion of the scar is located and the proposed incision line is mapped out transversely across that portion with brilliant green. Other similar areas are treated in the same way. The scar is then divided through its full depth to normal tissue. If the scar is very thick, then a wedge-shaped slice can be taken out of the entire length on each side and the thin outer surface edges may be drawn down to the normal base by a few Y sutures of horsehair. This will make subsequent grafting easier. While these incisions may be made in any direction according to the pull of the scar, in the extremities it is better if they parallel the long axis of the extremity.

The procedure may have to be done in stages, as much as possible being gained with each one. The stages should be followed by massage and other physiotherapy.

If the blood supply permits, a graft of the Ollier-Thiersch type may be applied. However, grafting may have to be put off until adequate granulation tissue is formed. The author gives a detailed description of the type of dressing to be used.

The unstable scar occurs most frequently in extensive loss of tissue, and the skull and extremities are most often affected. Before they are treated, it is best to have them entirely healed. If this is not possible, then, with proper sterilization, the bacterial count may be so lowered that it is comparatively safe to proceed. The incisions should extend into the normal tissue outside of the scar, and down to the deep fascia. There is usually a wide gaping of the wound and these gaps are dressed as are the wounds of the thick contracted scar. As before, skin grafting may be done immediately or after the subsequent development of granulation tissue.

By the utilization of the Z-shaped or modified Z-shaped relaxation incisions, flaps of scar tissue, or tissue that is infiltrated with scar may be used for the relief of binding scar contractures. This type was first used by Denonvilliers in 1856. The contracted scar with binding bridles or webs is usually located where the extremities join the trunk, as in the axilla, and also on the face and neck. It is usually best to delay operative treatment on these scars for at least six months after healing, and during this time massage and passive motion can be used. The author emphasizes that the point of the Z incisions should be blunt and that in the handling of the flaps made by undercutting, hooks should be used so that there is no bruising of the tissue. Also, some subcutaneous tissue should be brought up with the flap, to give it a good blood supply. The central line of the Z incision should be over the most prominent part of the scar, and in the grooved scar the central line should split the groove lengthwise.

In some instances relaxation may be obtained if an opening is "burrowed" completely under the scar and strips or tubes of whole-thickness skin are implanted. After two weeks have elapsed the scar above the graft is incised; it will gape widely, relax the scar itself, and leave a skin graft in the bottom of the defect.

The author emphasizes that in all of these conditions the scar tissue or skin infiltrated with scar is utilized. Furthermore, the hastening of healing of the relaxation defects by skin grafting or flap shifting is a secondary measure, as healing would be unsuccessful were it not for the relaxation of the scar.

ALTON OCHSNER, M.D.

ANESTHESIA

O'Brien, J. D., and Steegmann, A. T.: Severe Degeneration of the Brain Following Nitrous-Oxide-Oxygen Anesthesia. *Ann. Surg.*, 1938, 107: 486.

The authors report the clinical and autopsy findings in a patient who suffered a postanesthetic encephalopathy and lived sixteen months thereafter. The patient, a white female of thirty-one, was given a nitrous-oxide-oxygen anesthetic for the removal of a bladder papilloma, transcystoscopically. During the anesthetic administration there was no evidence of any unusual reaction. The patient did not awaken from her anesthesia for eight or nine hours, when she had maniacal behavior interrupting the coma, from which she failed to return to a conscious type of mental activity. Five days later she developed generalized muscular twitchings, and five months later she presented the typical picture of decerebrate rigidity. She had a remittent type of fever which would vary from 102 to 106° F. for several weeks, and then she would remain normal for a time. The spinal fluid was examined many times and consistently showed a pressure of about 250 mm. of water, but otherwise was negative. The blood findings were normal with the exception of a moderate leucocytosis. Death occurred suddenly, sixteen months following the operation.

Permission was given for a head autopsy only. This revealed a massive subdural hematoma, 1 mm. in thickness, which covered all of the dura. The brain weighed only 900 gm. after formalin fixation. The histological picture was one of marked degeneration of the ischemic type, affecting especially the third and fourth cortical layers. The ganglion cells were either entirely gone or shrunken. The authors believe that the cellular changes were those of anoxemia, but the exact type or origin was not evident. The process was entirely degenerative and not associated with any inflammation or previous vascular damage. They do not believe that there had been any specific predisposition, since the patient in question had had a previous nitrous-oxide-oxygen anesthetic. There were no evidences of previous generalized or cerebral disease. The authors do not believe that any relationship can be shown in this case to an abnormal carotid-sinus reflex. They suggest that there may have been a local vulnerability of the brain in this particular case,

but leave the consideration of this to a future publication. WILLIAM C. BECK, M.D.

Gebauer, P. W., and Coleman, F. P.: Postanesthetic Encephalopathy Following Cyclopropane. *Ann. Surg.*, 1938, 107: 481.

The authors report a case of degenerative changes in the brain following cyclopropane anesthesia. The patient, a white female of twenty-nine years, was subjected to a first-stage thoracoplasty for pulmonary tuberculosis. Cyclopropane was administered by the carbon-dioxide-absorption technique. The condition of the patient during the operation was good. Twenty-four hours after the operation the patient vomited, and thirty-six hours after, she had a convulsion and became comatose. The fever rose continuously and she became cyanotic and remained so, even in the face of the continuous administration of oxygen. There was a slight hemoglobinuria and the skin assumed a subicteric tint. The patient soon assumed the picture of decortication with meningeal irritation. The blood and spinal fluid findings were essentially negative. The patient died seven days and six hours postoperatively.

Autopsy revealed pulmonary tuberculosis, with hemorrhagic erosion of the gastric mucosa, acute ulceration of the urinary bladder, and passive hyperemia of the kidneys. Grossly the brain was normal as were hematoxylin-eosin sections. With Nissl and Hortega stains, the leptomeninges showed inflammation with fibroblastic proliferation. There was a severe degeneration of the ganglion cells of the entire cerebral cortex. The most severe damage was found in the temporal lobes and hippocampal gyri. In general the cell damage was of the ischemic type, resembling remarkably the changes seen in a brain damaged by the ischemia following a vascular occlusion.

The authors do not believe that during the period of the operation there was an anoxemia of sufficient degree to produce the changes in the brain. They do admit, however, that there may have been a localized anoxia which did not give any clinical manifestations. They believe that the most likely explanation is that the mechanism of cyclopropane anesthesia, like that of nitrous oxide, depends in part on anoxemia, but, unlike that of nitrous oxide, the anoxemia is localized and clinical cyanosis is lacking. It may be that many so-called specific, toxic, and poisonous substances operate on the brain and other organs through the production of cellular asphyxia.
WILLIAM C. BECK, M.D.

Jones, O. R., and Burford, G. E.: Massive Atelectasis Following Cyclopropane Anesthesia. *J. Am. M. Ass.*, 1938, 110: 1092.

The authors report in detail 4 deaths which have occurred following the use of cyclopropane as an anesthetic. Autopsy of these cases showed massive collapse of one or both lungs. The authors also comment at length upon the fact that pulmonary complications following long-continued cyclopropane anesthesia, especially for operations on the stomach, have increased more than should be expected.

Complete atelectasis of a whole lobe has of recent years been assumed to be obstruction in the main bronchus followed by absorption of the alveolar gases behind the obstruction. When the obstruction has become effective, the time required for the development of atelectasis depends on the rate of absorption by the lung of the gases distal to the obstruction, provided the circulation in the lung is intact and the alveolar epithelium undamaged. Great variations occur in the rate of this absorption. Anesthetic gases are absorbed in a matter of minutes, as are also oxygen and carbon dioxide. The inert gases, helium, hydrogen, and nitrogen, require from eighteen to twenty-six hours for absorption. The normal lung filled with air contains about 79 per cent of an inert gas, nitrogen, which has a supporting effect upon the expanded alveoli.

When during an operation the rapidly absorbable gases fill the alveoli this support is quickly lost as the gases are absorbed and the alveoli collapse because of the lack of inert gas which should be present to keep them distended. This condition favors atelectasis of the lungs.

In this way the authors explain the fact that collapse of the lungs occurred in these 4 cases, which in 3 instances occurred only some minutes after the anesthetic had been discontinued and the operation finished. In no case was an obstructing plug found at autopsy in any of the main bronchi.

The obvious remedy is to add inert gas of one type or another to the cyclopropane mixture. Nitrogen would be effective, but the most useful is either hydrogen or helium. J. DANIEL WILLEMS, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Esguerra-Gómez, G.: Radiology in Amebiasis Diagnosis. *Radiology*, 1938, 31: 15.

Of 6,540 coprological examinations made in Bogotá, Colombia, 20.16 per cent were positive for entamœba histolytica. Of 2,218 hospital examinations in children, 11.18 per cent were positive. In a similar number of hospital examinations in adults, 37.01 per cent were positive. Seventeen and eight-tenths per cent of 500 examinations in one private laboratory, and 10.04 per cent of 1,604 examinations in another private laboratory were positive.

The radiological findings in amebic infestation are relatively little known. The author was astonished to find so little scientific literature on the subject. He quotes the observations of several authors.

It is usually the case of chronic amebiasis with variable digestive disorders, but without dysenteric phenomena, that comes to the radiological laboratory. The radiological signs noted by the author are several. The first is an increased rapidity of the travel of the first part of the opaque meal through the cecum-colon segment. Often the barium may be found in the sigmoid and rectum at the end of six hours. A part of the same meal which traveled through the colon so rapidly may be retained in the stomach from twenty-four to seventy-two hours. Another radiological sign is hypersegmentation of the cecum-colon segment, more especially in the transverse colon, at the six-hour period. There is marked inequality in these segmentations, but as a general rule the same narrowing and change of contour persists in the same segments in all examinations. It is a relatively common observation that the fore part of the opaque meal is distributed in zones quite isolated from one another, and often impregnates the mucosa and shows hypertrophy of the folds. Diminution or absence of haustral markings, or segmentations of the cecum and colon, is observed in those few cases accompanied by ptosis of the transverse colon, dilatation, and wall atony, in which the amebic infestation started long ago. Examination by the opaque enema method frequently demonstrates a uniform narrowing of the left part of the colon with decreased elasticity of the walls.

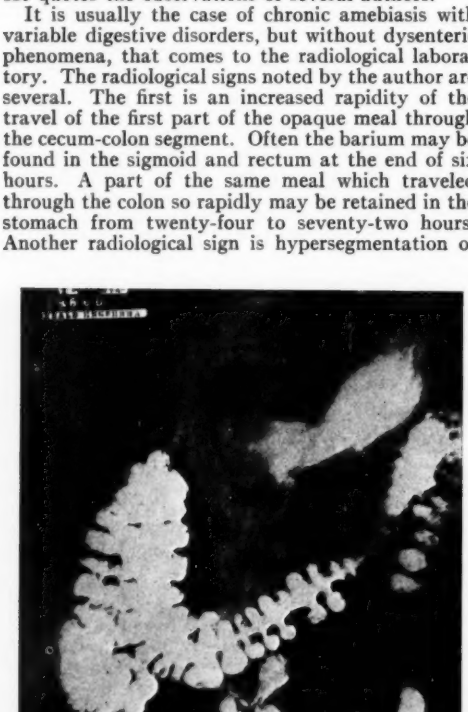


Fig. 1.

It is possible not to find any diagnostic radiographic signs at the onset of acute amebiasis or in cases in which dysenteric phenomena are slight. The author quotes abstracts of several interesting case reports and presents illustrations to demonstrate the characteristic findings. Figure 1 demonstrates the six-hour gastric retention, hypersegmentation, irregularity of the colon, and the rapid progress of the meal at the six-hour period in a case of amebiasis.

The most common radiological findings are segmentary induration of the cecum and colon walls and the presence of "saw tooth" contours. Such radiological changes in isolated intestinal segments are characteristic of the presence of ulceration.

HAROLD C. OCHSNER, M.D.

Soto, J. A., Brunschwig, A., and Schlutz, F. W.: An Experimental Study of the Effects of Roentgen Irradiation upon Acute Pyogenic Infection of the Skin and Subcutaneous Tissues. *Surgery*, 1938, 3: 593.

Although the beneficial effects of roentgen irradiation upon a large variety of acute and chronic infections in man have been repeatedly cited in the literature for many years, controlled experimental evidence for the efficacy of such treatment in acute pyogenic infections has been reported in but a relatively few instances. Some of the observations of this nature are reviewed briefly. Because of the fact that most of the conclusions drawn are based upon results obtained when different animals were used as controls, their reliability seems questionable. The authors attempted to check them by a series of experiments in which non irradiated control lesions were produced in every instance in the same animal that bore irradiated lesions.

For this purpose, groups of rabbits were injected with various types of pyogenic bacteria and observations were made before and after irradiation with various doses of roentgen rays given at variable

intervals before and after the injections. Observations were made, in each instance, of the degree of inflammation and the time of healing. In order to obtain information as to a possible cause for the changes observed, microscopic examinations of sections of the involved areas and smears of pus obtained from them were also studied. A separate set of experiments to determine the effects of irradiation on capillary permeability as a possible cause for the changes noted were also carried out. Finally, exposures were given to cultures of bacteria *in vitro* to ascertain if the addition of rabbit's serum to the culture medium would influence their reaction in any way. The results in connection with the last test were negative. Detailed descriptions of the experiments are included.

The authors' conclusions are as follows:

1. Moderate doses of 200-kv. roentgen irradiation, filtered by 1 mm. copper and 1 mm. aluminum, i.e., 600 roentgens, reduce the severity of acute pyogenic infections in the skin and subcutaneous tissues, but do not necessarily hasten the final healing of these lesions. In a small percentage of cases the irradiated lesions healed more slowly than the controls.

2. The optimum opportunity for beneficial effects is obtained when the irradiation is given shortly after the injection of the organisms (within five hours) and decreases as the suppurative phase (abscess formation) of the infection becomes more prominent. Irradiation twenty-four hours prior to bacterial injection did not inhibit the severity of the subsequent lesions; indeed, some of the lesions in such areas healed more slowly than the controls.

3. No evidence was obtained that the beneficial effects of roentgen irradiation in inflammatory processes are due to widespread destruction of the leucocytes, especially lymphocytes in the field with liberation of antibacterial ferments. In fact, the exudate in the irradiated lesions was practically identical with that in the controls.

4. Evidence is presented to indicate that a factor in the mechanism of the beneficial action of irradiation is an effect upon the capillary bed of the field, which results in more rapid absorption of soluble substances from the inflamed areas. This would permit of a less intense leucocytic mobilization to cope with the infection. ADOLPH HARTUNG, M.D.

Doub, H. P., Hartman, F. W., and Mitchell, C. L.: The Immediate and End-Results of Radiation Therapy in Certain Benign Bone Tumors. *Radiology*, 1938, 30: 420.

The characteristic roentgenological and pathological findings in giant-cell tumor are discussed in some detail, and the results of treatment as reported by various authors are abstracted. The authors recently made a study of 22 cases of benign giant-cell tumor from the Bone Tumor Registry, which had sections showing the histology of the original tumor, and a satisfactory follow-up later. There were 9 cases treated by radiation only in which the patient remained well. In 3 cases of benign giant-cell tumor in which radiation therapy was administered, the lesions later became malignant. In 5 cases in which radiation therapy was applied, resection or amputation was performed later.

The malignant variation of giant-cell tumor is discussed in some detail, and the literature on this subject is reviewed.

The authors report 4 cases of giant-cell tumor treated by them in which there was an adequate follow-up. One of the patients developed evidence of fibrosarcoma, although the original finding was benign giant-cell tumor. The authors believe that roentgen therapy and surgery should not be combined in the treatment of giant-cell tumors. Recorded statistics show a high percentage of cured cases resulting from radiotherapy. There is an increasing number of cases reported in the literature in which there is a transition from benign giant-cell tumor to osteogenic sarcoma. The cause of this transition is not clear, although injury or chronic irritation may be responsible. The small, repeated doses of roentgen therapy often used in the treatment of giant-cell tumor may have a stimulative effect on the tumor cells. The authors raise the question of increasing roentgen dosage to higher limits.

HAROLD C. OCHSNER, M.D.

Leucutia, T.: Three-Year Results in the Treatment of Malignant Neoplasms with Supervoltage Roentgen Therapy. *Radiology*, 1938, 30: 356.

Supervoltage roentgen therapy implies the use of roentgen rays which are obtained with voltages higher than 200 kv., in contradistinction to deep roentgen therapy which means irradiation with a voltage of 200 kv. or thereabouts. In Harper Hospital, Detroit, during the years 1933 and 1934, 312 cases of malignant neoplasms were treated mostly with roentgen rays obtained with 500 kv. equivalent (7 mm. Cu. forefilter). These cases are now analyzed, and the results are compared, on the basis of survival curves, with those which were obtained with the 200 kv. equivalent radiation in previous years, some of the comparisons dating as far back as 1922, or fifteen years.

The material is divided into three main groups: (1) cases which proved complete failures after the 200 kv. equivalent radiation and later were subjected to supplemental irradiation with 500 kv. equivalent; (2) cases which were primarily irradiated with 500 kv. equivalent, but in which results or survival curves showed no change from the 200 kv. equivalent radiation therapy; (3) cases which were primarily irradiated with 500 kv. equivalent and in which there was a very definite improvement when compared to those receiving 200 kv. equivalent radiation therapy.

It is a custom at Harper Hospital to classify all malignant neoplasms, as far as possible, into 5 stages, according to the degree of demonstrable clinical extension. These stages are: I, local lesion; II, metastases to the first regional lymph nodes; III,

metastases to the second regional lymph nodes through anastomosis with the first; IV, wide local invasion by continuity; and V, distant metastases. When supervoltage roentgen therapy was first introduced in 1933, and during the following year of 1934, it was applied chiefly to cases of Stages III and IV. The cases in Stages I and II are considered operable and, therefore, in these groups the old established methods of treatment were pursued either by employing a combination of surgery and irradiation, or by irradiation alone with a technique as formerly practiced. Stage V, on the other hand, represents such extensive dissemination of the malignant process that the possibility of a cure is practically eliminated, and palliation may be brought about by other less expensive methods.

A tabular arrangement of the three-year results permits the following conclusions:

1. If a thorough irradiation with 200 kv. equivalent has led to failure in a certain instance, the supplemental irradiation with 500 kv. produced no material improvement in the final results.

2. In the cases primarily treated with supervoltage roentgen therapy, no change in the law of radiosensitivity was observed when comparison was made with the 200 kv. irradiation. It appeared in this respect that there is no direct quality dependence or selective reaction. The groups of malignant tumors which proved to be unfavorable to the 200 kv. equivalent irradiation continued to remain unfavorable also to the 500 kv. equivalent irradiation.

3. Primary supervoltage roentgen therapy with or without association of other methods led to better results in all those instances in which the irradiation had been rendered more efficacious than the 200 kv. equivalent radiation, but in which the malignant process was still of local character although the invasion by continuity appeared very considerable. The increased efficacy may be attributed to better absorption conditions, and signified an indirect quality dependence or differential action. If all malignant neoplasms are divided into 5 clinical stages, it is found that supervoltage roentgen therapy leads to definite improvement of the three-year results in Stages III and IV, in those groups which were favorable also to the 200 kv. equivalent radiation. The best example is represented by the carcinoma of the uterine cervix in which the percentage of three-year survival was increased from 30 to nearly 60. A similar improvement was obtained in certain bulky skin cancers, in carcinoma of the rectum, in the earlier cases of carcinoma of the prostate, in some types of sarcoma, in carcinoma of the thyroid, and to a lesser extent, in metastatic carcinoma of the lymph nodes of the neck.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Bond, D. D., and Wright, D. G.: The Treatment of Hemorrhage and Traumatic Shock by the Intravenous Use of Lyophile Serum. *Ann. Surg.*, 1938, 107: 500.

Normal blood serum may be preserved in desiccated form. Essentially, this procedure is one of rapid freezing at a very low temperature, and rapid dehydration from the frozen state under high vacuum. This leaves all the solid elements of the serum in a dry form. The proteins appear to be unaltered and their antibody properties are preserved in full titer. In this form serum may be preserved for extended periods; it is readily dissolved in water to make an isotonic or hypertonic solution. Because of its rapid solubility, this product is called "lyophile." For intravenous use, serum must be processed twice by this method, with an intermediate filtration to remove fat particles.

Experiments were performed in which lyophile serum was redissolved in water and then injected intravenously into dogs in which the blood pressure was severely reduced by trauma to the gut or to an extremity, and by acute hemorrhage. The blood pressure was raised and maintained for at least several hours by this procedure. The immediate availability of lyophile serum, its theoretic suitability, and its action upon animals in shock, suggest its use for clinical shock and hemorrhage.

JOHN H. GARLOCK, M.D.

Black, J. I. M.: The Lympho-Epitheliomas. *J. Laryngol. & Otol.*, 1938, 53: 225.

We are indebted for the idea and first description of the lympho-epitheliomas to Regaud and Schminke, who published independent papers in 1931. It seems that attention was first turned to this class of neoplasm because of an extreme degree of radiosensitivity. This characteristic was coupled with a distinctive histological structure and a certain number of clinical indications which were thought to justify a separate group and name for the neoplasm described. Regaud originally noted a tumor consisting of two elements, a primitive type of epithelium and lymphocytes, and suggested that the association was constant and characteristic, and therefore justified the name lympho-epithelioma.

Apart from confusions due to variations in the class, a confusion with other similar tumors easily occurs and there is no doubt that the histological diagnosis can be extremely difficult. Ewing pointed out the difficulty of differentiation from the transitional-celled carcinomas; moreover, previous authors had apparently not thought the lympho-epitheliomas worthy of a special class and included them in the epitheliomas as such or as transitional-celled carcinomas. It must be stated that although the lympho-epitheliomas possess certain outstanding features, these features are by no means confined to this class alone but are shown equally as well by any highly malignant, rapidly growing, and radiosensitive tumor, such as a transitional-celled carcinoma of little differentiation, a sarcoma, and even a lymphadenoma. The diagnosis must rest upon a histological examination and is of great importance with regard to the prognosis. It may be said that the features shown are: a tendency toward early spread to adjacent lymph nodes while the primary lesion is still small and obscure, a great radiosensitivity of the lesions which are produced, and, after treatment, a tendency toward distant metastases to the vertebral column and abdominal organs. Apart from the thymus the neoplasm arises, as a rule, in the tonsillar region or nasopharynx, although cases have been described in which it occurs in the hypopharynx and the thyroid. A significant fact is that no one has yet described a lympho-epithelioma of intestinal origin. The age at which it is most commonly found seems to be middle or late life, although Ewing states that a similar or identical tumor occurs in young people at about fifteen years of age. The tumor seems to be slightly more common in males, and as a general rule it seems that its occurrence is unlikely during the period of development and greatest activity of the lympho-epithelial organs. In all the highly malignant types of neoplasm with a special predilection for early metastases it has been found that surgical extirpation holds little or no hope of cure. The lympho-epitheliomas are no exception to this rule and, in addition, occur in places which because of their inaccessibility are particularly unsuited for radical surgical extirpation.

It is said that the untreated lympho-epitheliomas run a fatal course in about two or three years, the end being reached with massive local spread of the tumor. Of the treated cases which have ended fatally, some have pursued the same course, local regression not having been obtained, while others have not shown any local recurrence, but terminated fatally as the result of distant metastases. The prognosis of the treated cases is variously stated in the literature, and some confusion seems to exist because of premature optimism. The final impression gained, then, is that of a malignant neoplasm running a fatal course in less than two years if not treated. Treatment by x-ray irradiation should produce very rapid local regression. Failing a quick response, the patient must be abandoned as hopeless. If a good immediate result has been obtained, local recurrence is unlikely, and if the patient passes the three-year limit without developing distant metastases, it appears that all will be well. It must always be remembered that lymph-node deposits can be treated and regression may be obtained,

but the treatment of skeletal deposits is probably useless.

The general impression gained from a study of these tumors is that of confusion, and many tumors which would possibly be described as lympho-epitheliomas have behaved in a variety of different ways and suggested that they are of different types. The small group which the author has isolated as sufficiently similar to be classified together gives the impression of a moderately well differentiated tumor, probably best thought of as sarcomatous; however, whether it is typical of what has been described as lympho-epithelioma is difficult to judge. At the moment it seems that the diagnosis of lympho-epithelioma is probably best left alone in clinical circles; a description of the tumor should be given, dealing principally with the degree of development of the large cells and the extent of lymphocytic content of the tumor. This will make possible the determination of the best treatment and a fairly accurate prognosis. JOSEPH K. NARAT, M.D.

Oster, R. H., and Salter, W. T.: Immunization against Neoplasm: Its Effect on the Nitrogen Metabolism of the Host. *Am. J. Cancer*, 1938, 32: 422.

In 1925 Dodds found that certain rats which resisted inoculation with neoplasms showed a low concentration of urea in the blood after treatment with roentgen rays. Independently several investigators had shown that inoculation of tumors into mice may confer immunity to subsequent inoculation, an immunity which persists after removal of the tumor. The term "immunity" is used here in a specialized sense to indicate resistance against tumor growth on the part of the host. This article presents evidence that animals so immunized show the peculiarity in nitrogen metabolism which Dodds described in naturally immune animals. It suggests that susceptibility to malignant disease has a definite chemical background.

The apparent concentration of urea in the blood during fasting of normal and tumor-bearing mice is about 30 mgm. per cent following twenty-four hours of fasting even after x-ray irradiation. Immune animals show the same value for urea until irradiated. Thereupon the apparent blood urea drops steadily for three days to about 20 mgm. per cent, and climbs back to normal in the course of the next week.

The excretion of nitrogen in the urine shows the urea to be consistently about 81 per cent and ammonia 9 per cent of the total amount of nitrogen excreted on a mixed diet. This is true despite an excessive excretion of nitrogen the day after x-ray treatment in both normal and immune animals. The drop in blood urea, therefore, is not due to a specific failure of the normal urea-producing mechanism.

The response of apparent blood urea is independent of the actual presence of a tumor, and indicates that the "immunity" is a property of the host primarily. Indeed, under certain special laboratory conditions, the chemical reaction may be used statistically to predict in average figures the approximate fate of inoculated neoplasms subsequently introduced. These observations suggest that the difference between a malignant and a benign tumor may exist in part in the chemical constitution of the host. JOHN H. GARLOCK, M.D.

Schneider, E.: Vitamins in Surgery (Die Vitamine in der Chirurgie). Stuttgart: Ferdinand Enke, 1937.

In the introduction to his book the author first gives a short review of the history of the discovery of the vitamins, and then continues his work with a relation of our present day knowledge of the nature and modus operandi of the Vitamins A, C, D, and the group of Vitamins B, which currently play the chief rôle in surgery. He then discusses the question of vitamin storage and vitamin requirement during the period of body growth, and thereby comes to the conclusion that the capability of man for storing Vitamin A is highly problematical, and that as far as Vitamin C is concerned this capability is completely absent. This fact can explain the phenomenon, that, within a relatively short time during the course of disease, secondary hypovitaminosis can make its appearance; but in many instances, it may take its course so insidiously that the typical clinical symptoms of a full-blown deficiency disease will hardly become obvious.

The basis for this fact is to be sought in the large span between the optimal vitamin dose and the particular amount of vitamin which is still sufficient to prevent the appearance of deficiency symptoms. The direct influence of the surgical procedure and/or the anesthesia upon the vitamin complex is to be seen, according to the scant publications which concern themselves with this question, in a transient increased vitamin requirement for Vitamins A and C, and an increased excretion of Vitamin A from the liver. A longer chapter is devoted to the secondary hypovitaminosis which makes its appearance as the usual accompanying symptom of inflammation. In every inflammatory process the brunt of the reparative activity falls, above all, upon the connective tissue, which is called upon to replace the increased cellular destruction. Vitamin C has greater significance for the connective tissue than any other vitamin, in a similar manner as Vitamin A is important for the epithelium (epithelium-protective vitamin). In the presence of an inflammation, therefore, the requirement for Vitamin C is particularly increased. However, the Vitamin C requirement is increased not only in inflammation but in every increased physiological activity of the cells.

The assimilation of Vitamin C into the cell body is brought about through the Golgi apparatus, i.e., a network consisting of protein bodies and lipoids, which permits exactly as much Vitamin C into the cell as the latter requires at the particular moment. For this reason, a storing of Vitamin C is just as impossible as an active increase of the cell function as the result of an increased administration of vitamins. In every inflammatory process, therefore, a hypo-

vitaminotic condition may rapidly develop, especially when the resorption conditions in the bowel are disturbed. In this condition the daily administration of 300 mgm. of cevitamic acid, given parenterally if necessary, has proved of therapeutic value. In a moderately severe pyogenic infection, correction of the Vitamin-C deficiency may be assumed to have been attained after about ten days; this can be proved through the increased Vitamin-C excretion in the urine.

However, not only is the requirement for Vitamin C increased in inflammatory processes, but there is also an increased demand for Vitamin A, which probably has its origin in the disturbances of the physiological activity of the pro-vitamins in the toxically damaged liver. At any event a high-grade deficiency of Vitamin A has been shown to exist in the liver in chronic inflammation. In addition to this viewpoint, another fact is of importance, i.e., that in addition to an increased consumption of Vitamin A, there is also an increased excretion of Vitamin A in the urine, a condition for which the Vitamin-C hypovitaminosis which occurs in inflammation is blamed.

Vitamin-C deficiency is supposed to increase the permeability of the intercellular substances of the kidney for Vitamin A, and attempts to stop the excretion of Vitamin A by the administration of Vitamin C have been successful. The author then reports the various hypotheses concerning the mode of action of the vitamins administered during infections, which various authors have attempted to explain on the basis of an increase of the catalytic activity of the blood, an increase in the efficiency of the reticulo-endothelial system, an increase of the bactericidal powers of the blood, and an increase in the detoxification powers of the blood. On the other hand, the author explains the favorable action of the auxiliary vitamin therapy in inflammations on the theory that this additional vitamin administration obviates a deficiency condition of the increasingly destroyed vitamins.

In the chapter concerning the hypovitaminosis of cancer patients, the author criticizes the partially contradictory observations concerning the stimulatory and/or depressing effect of vitamins on tumor growth. On the basis of his own researches, he comes to the conclusion that Vitamin C has a reducing action similar to the reducing action of sodium bisulfite and sodium thiosulfate and is capable of exerting a depressing influence upon the tumor growth and at the same time increasing the resistance powers of the organism, and he recommends the supplemental administration of Vitamin C in patients suffering from cancer.

In the treatment of wounds the secondary hypovitaminoses similarly play a great rôle, and these have been successfully combated by the parenteral administration of cod-liver-oil salves of high vitamin content, since Loehr, Unger, and Zacher, as well as Saito have conclusively shown the resorption of the fat-soluble Vitamins A and D. Kasahara and Kawashima have proved the direct assimilation of Vitamin D from the wound surface. Eitel has demonstrated, through the administration of doses of thyrotropic hormone, an increase in the rapidity of wound healing by the indirect means of stimulating the thyroid. He has also shown this to take place on a hormonal basis, an indication of the close relationship between the mode of action of the vitamin and the hormone. The author then occupies himself at length in the rest of the chapter with the hormonal disturbances due to the disturbance of the vitamin balance, and critically explains the relationship between Vitamins A and C on the one hand, and the thyroid hormone on the other. Vitamin A has an anti-thyroidal action and when given in large doses hinders the metabolism of glycogen in the liver. Vitamin C in hyperthyroidism acts only in the sense of a function regulator and not in an anti-thyroidal manner as Vitamin A.

Of value for the surgeon are the practical conclusions, which the author draws from his observations, with reference to the operative risks and secondary hypovitaminosis. He recommends that in cases with a hypovitaminosis of Vitamins A and C which is capable of increasing the danger, the Vitamins A and C be administered in abundant doses, because in this way liver-protecting therapy in the sense of glycogen fixation can be exerted, and a strengthening of the reticulo-endothelial system and a protective action on the epithelium will follow.

In addition to the discussion of the Moeller-Barlow disease and rickets, the author devotes himself extensively in the following chapter to the question of the origin of epiphyseal necrosis, which he for the first time associates with hypovitaminosis of Vitamin A. He attributes the latter to a possible disturbance in the co-relation between Vitamins A and D in which the Vitamin D is present in excess. As to the relationship between hypovitaminosis and calculus-forming diseases, we can rely only upon suppositions. Since Vitamin A is an epithelium-protecting vitamin, it may possibly be of value in the after-treatment of patients with calculi, in the sense that it may prevent an excessive proliferation of epithelium in the mucous membrane, and in this manner prevent the formation of new calculi.

In conclusion, the author discusses the limitations and efficiency of vitamin therapy, and at the same time warns against over-enthusiastic expectations. He expresses the hope, however, that as a result of further research, the possibility of therapeutic use of the vitamins may yet reach an unexpected expansion. (Loehr). HARRY A. SALZMANN, M.D.

GENERAL BACTERIAL, PROTOZOAN, AND PARASITIC INFECTIONS

Longcope, W. T.: Problems Relating to the Invasive Properties of Hemolytic Streptococci and Their Control by Sulfanilamide. *Am. J. M. Sc.*, 1938, 195: 577.

The author states that the variety, special character, severity, and outcome of hemolytic strepto-

coccal infections are probably determined by many factors, and depend upon the predominance of one or another of the biological properties of the organism and upon the varying states of resistance or susceptibility, and immunity or allergy that modify the responses to infection. Particularly unfavorable signs are a continuous local spread of the infection and an invasion of the blood stream. In a study of 166 cases of hemolytic streptococcal septicemia, mainly in adults, a fatality rate of 75.3 per cent was found. Excluding the few cases of scarlatina and endocarditis, the highest mortality occurred in erysipelas and cellulitis, and the lowest in mastoiditis. Invasion of the blood stream was most frequently demonstrated during the first week and after the fifteenth day of the disease. The average duration of the disease in the fatal cases was only twelve and one-half days. Most dangerous to life is the extension of the infection to the peritoneal cavity or to the meninges; at least 95 per cent of patients with meningitis succumb, and the mortality in peritonitis is perhaps still higher.

The pharmacological and experimental action of sulfanilamide is discussed and its remarkable therapeutic effect in the serious infections due to hemolytic streptococci is recorded. Sulfanilamide has a most pronounced effect in the early stages of these infections. Experimental and clinical studies have indicated that the drug is most effective when the infecting organism is subjected to a concentration of the chemical sufficient to produce an optimal bacteriostasis and when the body acquires and retains the power to rid itself of comparatively small numbers of viable and perhaps highly virulent organisms. Elimination of hemolytic streptococci from persistent and latent infections of the tonsils is not always produced by the use even of comparatively large amounts of the drug over considerable periods of time.

The surgical methods which are commonly employed in the treatment of infections should not be abandoned when sulfanilamide is used; free drainage of infected areas is undoubtedly beneficial. The author recounts some of the evidences of intoxication and points out that the most alarming of these are rare and depend probably upon an individual idiosyncrasy to this drug.

WALTER H. NADLER, M.D.